IB DIPLOMA Topical Past Papers

PHYSICS

SL

PAPER 1

2017 — 2022

IB TOPICAL PAST PAPERS

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Using the Search Function:

1. **Open the PDF**: Launch Adobe Reader, Acrobat, or your preferred PDF reader.
2. **Initiate Search**: Press `Ctrl+F` on Windows or `Cmd+F` on macOS to open the search function.
3. **Enter the Question Number**: Each question and answer in this document has a specific question number, formatted like a past paper code (e.g., PHYSI/22_SL_Summer_2017_Q1). Type this code, which is provided against each question and answer, into the search bar.
4. **Jump to the Solution**: After entering the question number, press 'Enter'. This will take you directly to the page containing the solution.

1 – (PHYSI/11_SL_Summer_2017_Q1) – *Measurements & Uncertainties*

What is the unit of electrical energy in fundamental SI units?

A. $\mathrm{kg\,m^2C^{-1}s}$

B. $\mathrm{kg\,m\,s^{-2}}$

C. $\mathrm{kg\,m^2s^{-2}}$

D. $\mathrm{kg\,m^2s^{-1}A}$

2 – (PHYSI/11_SL_Summer_2017_Q2) – *Measurements & Uncertainties*

Which of the following is a scalar quantity?

A. Velocity

B. Momentum

C. Kinetic energy

D. Acceleration

3 – (PHYSI/12_SL_Summer_2017_Q1) – *Measurements & Uncertainties*

A stone falls from rest to the bottom of a water well of depth d. The time t taken to fall is $2.0 \pm 0.2\,\mathrm{s}$. The depth of the well is calculated to be 20 m using $d = \frac{1}{2}at^2$. The uncertainty in a is negligible.

What is the absolute uncertainty in d?

A. $\pm 0.2\,\mathrm{m}$

B. $\pm 1\,\mathrm{m}$

C. $\pm 2\,\mathrm{m}$

D. $\pm 4\,\mathrm{m}$

4 – (PHYSI/12_SL_Summer_2017_Q2) – *Measurements & Uncertainties*

Which is a vector quantity?

A. Pressure

B. Electric current

C. Temperature

D. Magnetic field

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5 – (PHYSI/10_SL_Winter_2017_Q1) – *Measurements & Uncertainties*

How many significant figures are there in the number 0.0450?

A. 2

B. 3

C. 4

D. 5

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6 – (PHYSI/10_SL_Winter_2017_Q2) – *Measurements & Uncertainties*

An object is positioned in a gravitational field. The measurement of gravitational force acting on the object has an uncertainty of 3% and the uncertainty in the mass of the object is 9%. What is the uncertainty in the gravitational field strength of the field?

A. 3%

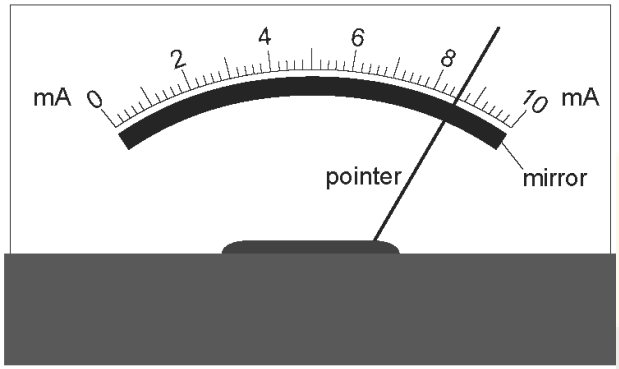
B. 6%

C. 12%

D. 27%

7 – (PHYSI/10_SL_Winter_2017_Q30) – *Measurements & Uncertainties*

The diagram shows an analogue meter with a mirror behind the pointer.



What is the main purpose of the mirror?

A. To provide extra light when reading the scale

B. To reduce the risk of parallax error when reading the scale

C. To enable the pointer to be seen from different angles

D. To magnify the image of the pointer

8 – (PHYSI/11_SL_Summer_2018_Q1) – *Measurements & Uncertainties*

A student measures the radius r of a sphere with an absolute uncertainty Δr. What is the fractional uncertainty in the volume of the sphere?

A. $\left(\frac{\Delta r}{r}\right)^3$

B. $3\frac{\Delta r}{r}$

C. $4\pi\frac{\Delta r}{r}$

D. $4\pi\left(\frac{\Delta r}{r}\right)^3$

9 – (PHYSI/12_SL_Summer_2018_Q1) – *Measurements & Uncertainties*

What is the best estimate for the diameter of a helium nucleus?

A. 10^{-21} m

B. 10^{-18} m

C. 10^{-15} m

D. 10^{-10} m

10 – (PHYSI/10_SL_Winter_2018_Q1) – *Measurements & Uncertainties*

What is the unit of power expressed in fundamental SI units?

A. kg m s^{-2}

B. $\text{kg m}^2\text{ s}^{-2}$

C. kg m s^{-3}

D. $\text{kg m}^2\text{ s}^{-3}$

11 – (PHYSI/10_SL_Winter_2018_Q2) – *Measurements & Uncertainties*

The length of the side of a cube is 2.0 cm ± 4%. The mass of the cube is 24.0 g ±8%. What is the percentage uncertainty of the density of the cube?

A. ±2%

B. ±8%

C. ±12%

D. ±20%

12 – (PHYSI/11_SL_Summer_2019_Q1) – *Measurements & Uncertainties*

A student wants to determine the angular speed ω of a rotating object. The period T is 0.50 s ±5%. The angular speed ω is

$$\omega = \frac{2\pi}{T}$$

What is the percentage uncertainty of ω?

A. 0.2%

B. 2.5%

C. 5%

D. 10%

13 – (PHYSI/11_SL_Summer_2019_Q2) – *Measurements & Uncertainties*

A student models the relationship between the pressure p of a gas and its temperature T as $p = x + yT$.

The units of p are pascal and the units of T are kelvin. What are the fundamental SI units of x and y?

	x	y
A.	$\mathrm{kg\,m^{-1}\,s^{-2}}$	$\mathrm{kg\,m^{-1}\,s^{-2}\,K^{-1}}$
B.	$\mathrm{kg\,m^{-1}\,s^{-2}}$	$\mathrm{K^{-1}}$
C.	K	$\mathrm{kg^{-1}\,m\,s^{-2}\,K^{-1}}$
D.	K	$\mathrm{K^{-1}}$

14 – (PHYSI/12_SL_Summer_2019_Q1) – *Measurements & Uncertainties*

A student measures the radius R of a circular plate to determine its area. The absolute uncertainty in R is ΔR.

What is the **fractional** uncertainty in the area of the plate?

A. $\frac{2\Delta R}{R}$

B. $\left(\frac{\Delta R}{R}\right)^2$

C. $\frac{2\pi\Delta R}{R}$

D. $\pi\left(\frac{\Delta R}{R}\right)^2$

15 – (PHYSI/12_SL_Summer_2019_Q2) – *Measurements & Uncertainties*

What is the unit of electrical potential difference expressed in fundamental SI units?

A. $\mathrm{kg\,m\,s^{-1}\,C^{-1}}$

B. $\mathrm{kg\,m^2\,s^{-2}\,C^{-1}}$

C. $\mathrm{kg\,m^2\,s^{-3}\,A^{-1}}$

D. $\mathrm{kg\,m^2\,s^{-1}\,A}$

16 – (PHYSI/10_SL_Winter_2019_Q1) – *Measurements & Uncertainties*

Which quantity has the fundamental SI units of $kg\,m^{-1}\,s^{-2}$?

A. Energy

B. Force

C. Momentum

D. Pressure

17 – (PHYSI/10_SL_Winter_2020_Q1) – *Measurements & Uncertainties*

Which quantity has the same units as those for energy stored per unit volume?

A. Density

B. Force

C. Momentum

D. Pressure

18 – (PHYSI/10_SL_Winter_2020_Q2) – *Measurements & Uncertainties*

A list of four physical quantities is

- acceleration
- energy
- mass
- temperature

How many scalar quantities are in this list?

A. 1

B. 2

C. 3

D. 4

19 – (PHYSI/11_SL_Summer_2021_Q1) – *Measurements & Uncertainties*

Which lists one scalar and two vector quantities?

A. Mass, momentum, potential difference

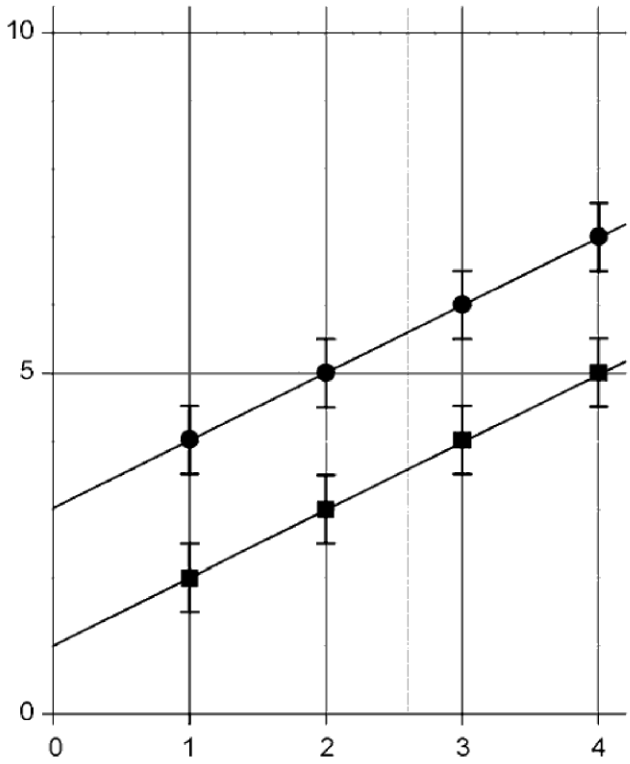
B. Mass, power, velocity

C. Power, intensity, velocity

D. Power, momentum, velocity

20 – (PHYSI/11_SL_Summer_2021_Q2) – *Measurements & Uncertainties*

Two sets of data, shown below with circles and squares, are obtained in two experiments. The size of the error bars is the same for all points.



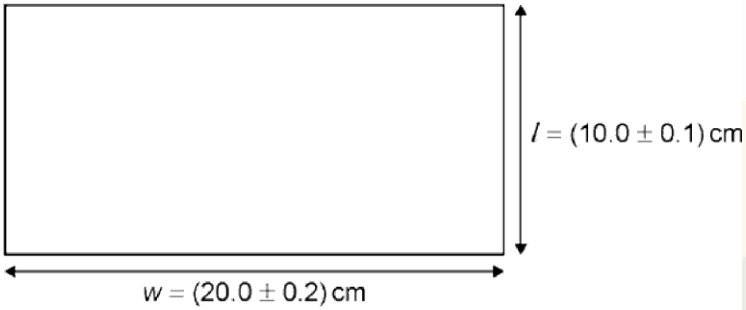
What is correct about the absolute uncertainty and the fractional uncertainty of the *y* intercept of the two lines of best fit?

	Absolute uncertainty	Fractional uncertainty
A.	larger for squares	same
B.	larger for squares	larger for squares
C.	same	same
D.	same	larger for squares

21 – (PHYSI/12_SL_Summer_2021_Q1) – *Measurements & Uncertainties*

A student measures the length l and width w of a rectangular table top.

What is the absolute uncertainty of the perimeter of the table top?



A. 0.3 cm

B. 0.6 cm

C. 1.2 cm

D. 2.4 cm

22 – (PHYSI/12_SL_Summer_2021_Q2) – *Measurements & Uncertainties*

What is the unit of power expressed in fundamental SI units?

A. kg m s^{3}

B. kg m s^{1}

C. $\text{kg m}^{2}\text{s}^{1}$

D. $\text{kg m}^{2}\text{s}^{3}$

23 – (PHYSI/10_SL_Winter_2021_Q1) – *Measurements & Uncertainties*

Which is a vector quantity?

A. Acceleration

B. Energy

C. Pressure

D. Speed

24 – (PHYSI/10_SL_Winter_2021_Q2) – *Measurements & Uncertainties*

A ball of mass (50 ± 1) g is moving with a speed of (25 ± 1) m s ^{1}. What is the fractional uncertainty in the momentum of the ball?

A. 0.02

B. 0.04

C. 0.06

D. 0.08

25 – (PHYSI/11_SL_Summer_2022_Q1) – *Measurements & Uncertainties*

What is the order of magnitude of the wavelength of visible light?

A. 10^{10} m

B. 10^{7} m

C. 10^{4} m

D. 10^{1} m

26 – (PHYSI/11_SL_Summer_2022_Q2) – *Measurements & Uncertainties*

The magnitude of the resultant of two forces acting on a body is 12 N. Which pair of forces acting on the body can combine to produce this resultant?

A. 1 N and 2 N

B. 1 N and 14 N

C. 5 N and 6 N

D. 6 N and 7 N

27 – (PHYSI/11_SL_Summer_2022_Q3) – *Measurements & Uncertainties*

A student measures the time for 20 oscillations of a pendulum. The experiment is repeated four times. The measurements are:

10.45 s

10.30 s

10.70 s

10.55 s

What is the best estimate of the uncertainty in the average time for 20 oscillations?

A. 0.01 s

B. 0.05 s

C. 0.2 s

D. 0.5 s

28 – (PHYSI/12_SL_Summer_2022_Q1) – *Measurements & Uncertainties*

The radius of a circle is measured to be (10.0 ± 0.5) cm. What is the area of the circle?

A. $(314.2 \pm 0.3)\ cm^2$

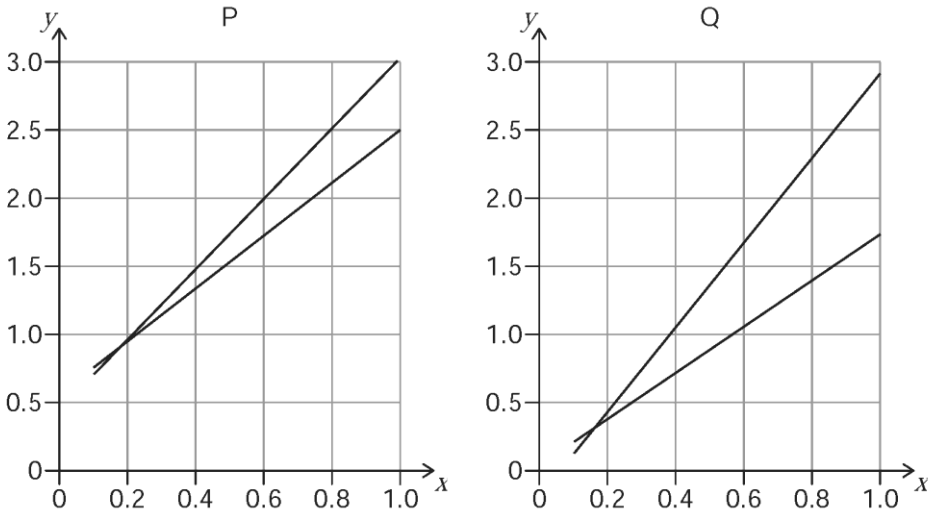
B. $(314 \pm 1)\ cm^2$

C. $(314 \pm 15)\ cm^2$

D. $(314 \pm 31)\ cm^2$

29 – (PHYSI/12_SL_Summer_2022_Q2) – *Measurements & Uncertainties*

Two different experiments, P and Q, generate two sets of data to confirm the proportionality of variables x and y. The graphs for the data from P and Q are shown. The maximum and minimum gradient lines are shown for both sets of data.

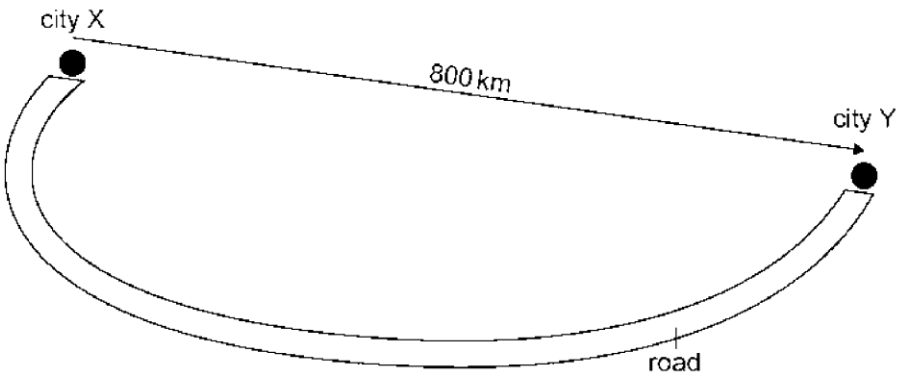


What is true about the systematic error and the uncertainty of the gradient when P is compared to Q?

	Systematic error	Uncertainty of the gradient
A.	larger for set P	larger for set P
B.	larger for set Q	larger for set P
C.	larger for set P	larger for set Q
D.	larger for set Q	larger for set Q

30 – (PHYSI/12_SL_Summer_2022_Q3) – *Measurements & Uncertainties*

The road from city X to city Y is 1000 km long. The displacement is 800 km from X to Y.



What is the distance travelled from Y to X and the displacement from Y to X?

	Distance travelled from Y to X / km	Displacement from Y to X / km
A.	800	800
B.	1000	800
C.	800	−800
D.	1000	−800

31 – (PHYSI/10_SL_Winter_2022_Q1) – *Measurements & Uncertainties*

A rectangular sheet of paper has dimensions of (30.0 + 0.5) cm and (20.0 + 0.5) cm.

What is the percentage uncertainty of the perimeter of the paper?

A. 1%

B. 2%

C. 2.5%

D. 4%

1 – (PHYSI/11_SL_Summer_2017_Q3) – *Mechanics*

An object is released from rest in the gravitational field of the Earth. Air resistance is negligible. How far does the object move during the fourth second of its motion?

A. 15 m

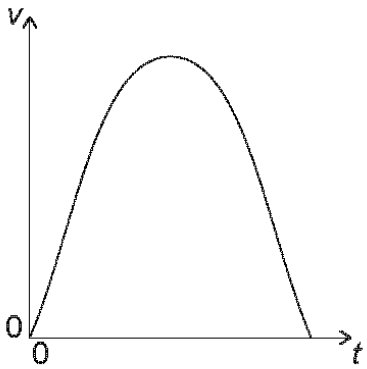
B. 25 m

C. 35 m

D. 45 m

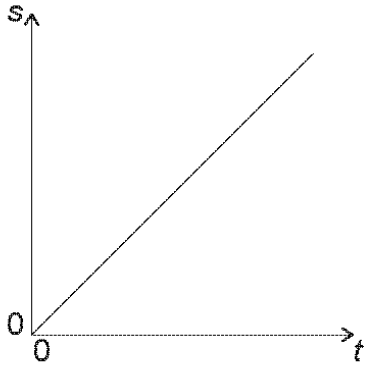
2 – (PHYSI/11_SL_Summer_2017_Q4) – *Mechanics*

The graph shows the variation of speed *v* of an object with time *t*.

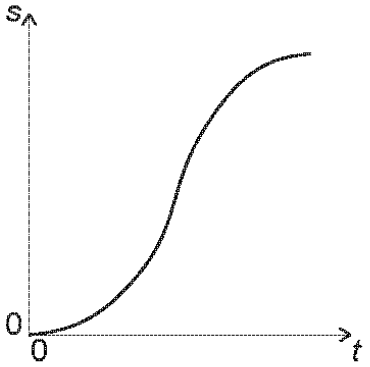


Which graph shows how the distance *s* travelled by the object varies with *t*?

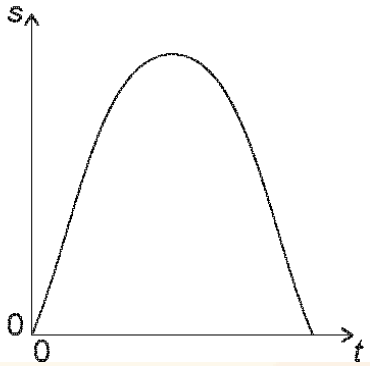
A.



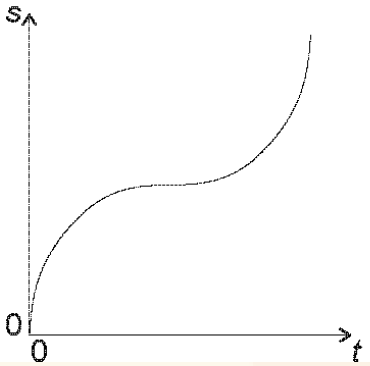
B.



C.

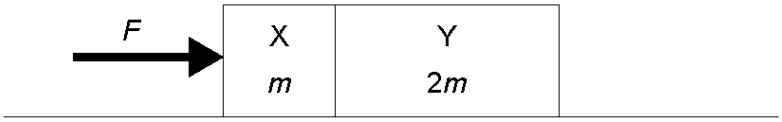


D.



3 – (PHYSI/11_SL_Summer_2017_Q5) – *Mechanics*

Two boxes in contact are pushed along a floor with a force *F*. The boxes move at a constant speed. Box X has a mass *m* and box Y has a mass 2*m*.



What is the resultant force acting on Y?

A. 0

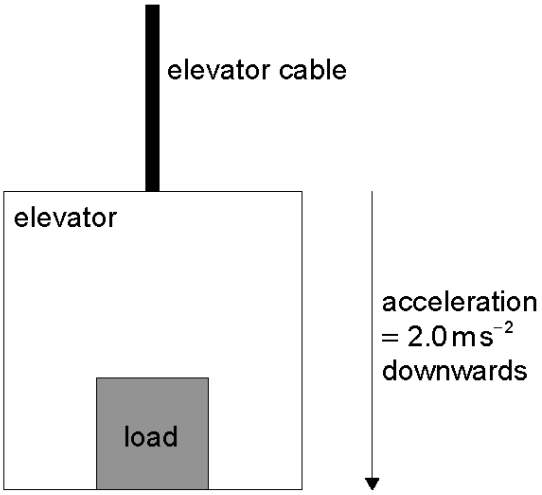
B. $\frac{F}{2}$

C. *F*

D. 2*F*

4 – (PHYSI/11_SL_Summer_2017_Q6) – *Mechanics*

An elevator (lift) and its load have a total mass of 750 kg and accelerate vertically downwards at 2.0 ms^{-2}.



What is the tension in the elevator cable?

A. 1.5 kN

B. 6.0 kN

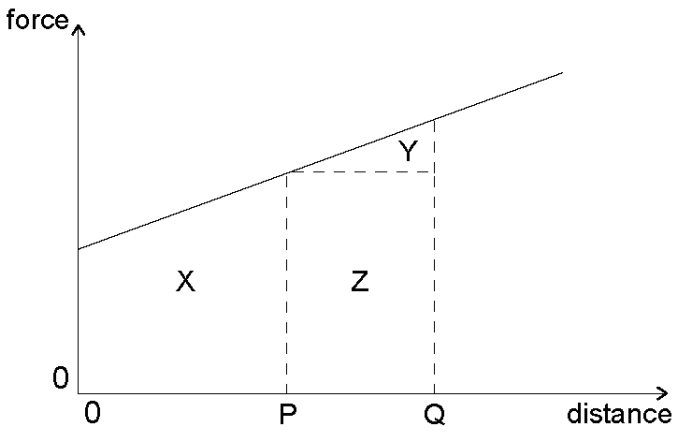
C. 7.5 kN

D. 9.0 kN

5 – (PHYSI/11_SL_Summer_2017_Q7) – *Mechanics*

A graph shows the variation of force acting on an object moving in a straight line with distance moved by the object.

Which area represents the work done on the object during its motion from P to Q?



A. X

B. Y

C. Y + Z

D. X + Y + Z

6 – (PHYSI/11_SL_Summer_2017_Q8) – *Mechanics*

A car travelling at a constant velocity covers a distance of 100 m in 5.0 s. The thrust of the engine is 1.5 kN.

What is the power of the car?

A. 0.75 kW

B. 3.0 kW

C. 7.5 kW

D. 30 kW

7 – (PHYSI/11_SL_Summer_2017_Q9) – *Mechanics*

An inelastic collision occurs between two bodies in the absence of external forces.

What must be true about the total momentum of the two bodies and the total kinetic energy of the two bodies during this interaction?

A. Only momentum is conserved.

B. Only kinetic energy is conserved.

C. Both momentum and kinetic energy are conserved.

D. Neither momentum nor kinetic energy are conserved.

8 – (PHYSI/12_SL_Summer_2017_Q3) – *Mechanics*

A ball is tossed vertically upwards with a speed of $5.0\,m\,s^{-1}$. After how many seconds will the ball return to its initial position?

A. 0.50 s

B. 1.0 s

C. 1.5 s

D. 2.0 s

9 – (PHYSI/12_SL_Summer_2017_Q4) – *Mechanics*

A projectile is fired horizontally from the top of a cliff. The projectile hits the ground 4 s later at a distance of 2 km from the base of the cliff. What is the height of the cliff?

A. 40 m

B. 80 m

C. 120 m

D. 160 m

10 – (PHYSI/12_SL_Summer_2017_Q5) – *Mechanics*

A tennis ball is released from rest at a height h above the ground. At each bounce 50 % of its kinetic energy is lost to its surroundings. What is the height reached by the ball after its second bounce?

A. $\frac{h}{8}$

B. $\frac{h}{4}$

C. $\frac{h}{2}$

D. zero

11 – (PHYSI/12_SL_Summer_2017_Q6) – *Mechanics*

The initial kinetic energy of a block moving on a horizontal floor is 48 J. A constant frictional force acts on the block bringing it to rest over a distance of 2 m. What is the frictional force on the block?

A. 24 N

B. 48 N

C. 96 N

D. 192 N

12 – (PHYSI/12_SL_Summer_2017_Q7) – *Mechanics*

The efficiency of an electric motor is 20 %. When lifting a body 500 J of energy are wasted. What is the useful work done by the motor?

A. 100 J

B. 125 J

C. 250 J

D. 400 J

13 – (PHYSI/12_SL_Summer_2017_Q8) – *Mechanics*

A net force acts on a body. Which characteristic of the body will definitely change?

A. Speed

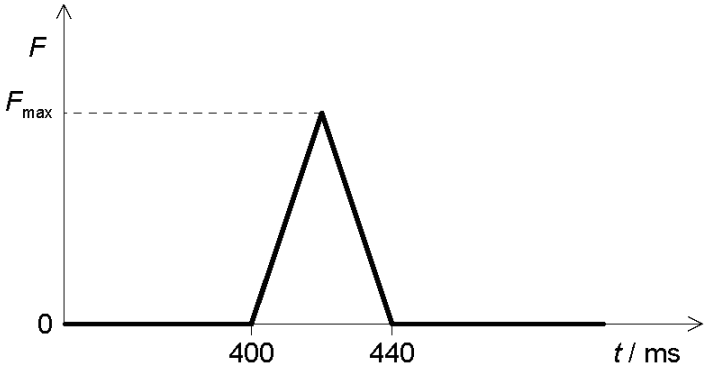
B. Momentum

C. Kinetic energy

D. Direction of motion

14 – (PHYSI/12_SL_Summer_2017_Q9) – *Mechanics*

A ball of mass 0.2 kg strikes a force sensor and sticks to it. Just before impact the ball is travelling horizontally at a speed of 4.0 ms^{-1}. The graph shows the variation with time t of the force F recorded by the sensor.



What is F_{max}?

A. 2 N

B. 4 N

C. 20 N

D. 40 N

15 – (PHYSI/10_SL_Winter_2017_Q3) – *Mechanics*

The variation of the displacement of an object with time is shown on a graph. What does the area under the graph represent?

A. No physical quantity

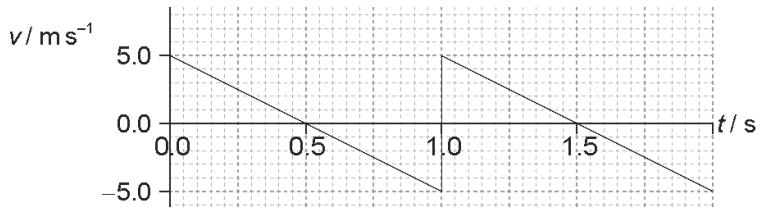
B. Velocity

C. Acceleration

D. Impulse

16 – (PHYSI/10_SL_Winter_2017_Q4) – *Mechanics*

An object is thrown upwards. The graph shows the variation with time *t* of the velocity *v* of the object.



What is the total displacement at a time of 1.5 s, measured from the point of release?

A. 0 m

B. 1.25 m

C. 2.50 m

D. 3.75 m

17 – (PHYSI/10_SL_Winter_2017_Q5) – *Mechanics*

An object is released from a stationary hot air balloon at height *h* above the ground. An identical object is released at height *h* above the ground from another balloon that is rising at constant speed. Air resistance is negligible. What does **not** increase for the object released from the rising balloon?

A. The distance through which it falls

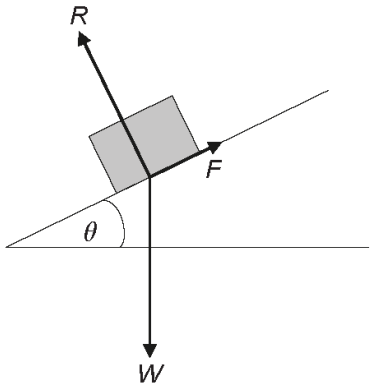
B. The time taken for it to reach the ground

C. The speed with which it reaches the ground

D. Its acceleration

18 – (PHYSI/10_SL_Winter_2017_Q6) – *Mechanics*

The diagram shows the forces acting on a block resting on an inclined plane. The angle θ is adjusted until the block is just at the point of sliding. R is the normal reaction, W the weight of the block and F the maximum frictional force.



not to scale

What is the maximum coefficient of static friction between the block and the plane?

A. $\sin\theta$

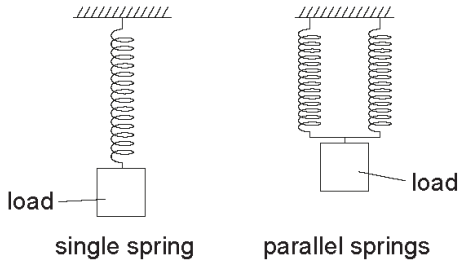
B. $\cos\theta$

C. $\tan\theta$

D. $\frac{1}{\tan\theta}$

19 – (PHYSI/10_SL_Winter_2017_Q7) – *Mechanics*

A system that consists of a single spring stores a total elastic potential energy E_p when a load is added to the spring. Another identical spring connected in parallel is added to the system. The same load is now applied to the parallel springs.



What is the total elastic potential energy stored in the changed system?

A. E_p

B. $\frac{E_p}{2}$

C. $\frac{E_p}{4}$

D. $\frac{E_p}{8}$

20 – (PHYSI/10_SL_Winter_2017_Q8) – *Mechanics*

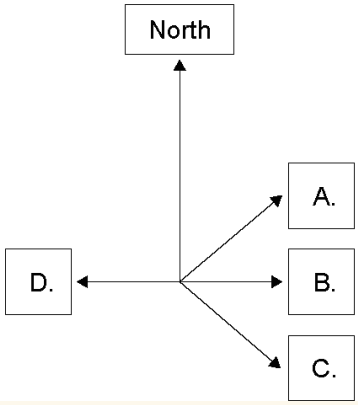
A moving system undergoes an explosion. What is correct for the momentum of the system and the kinetic energy of the system when they are compared immediately before and after the explosion?

	Momentum	Kinetic energy
A.	conserved	increased
B.	conserved	conserved
C.	increased	conserved
D.	increased	increased

21 – (PHYSI/11_SL_Summer_2018_Q2) – *Mechanics*

A river flows north. A boat crosses the river so that it only moves in the direction east of its starting point.

What is the direction in which the boat must be steered?



22 – (PHYSI/11_SL_Summer_2018_Q3) – *Mechanics*

An object is projected vertically upwards at time $t = 0$. Air resistance is negligible. The object passes the same point above its starting position at times 2 s and 8 s.

If g = 10 m s^{-2}, what is the initial speed of the object?

A. 50

B. 30

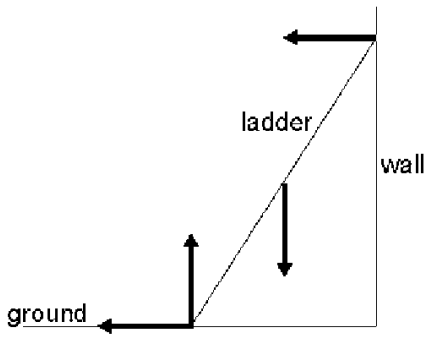
C. 25

D. 4

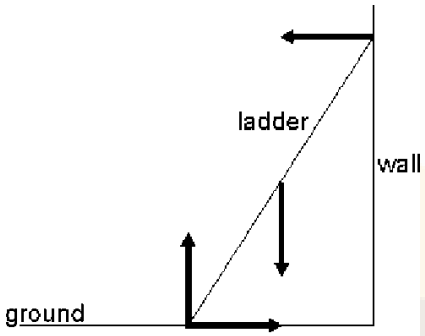
23 – (PHYSI/11_SL_Summer_2018_Q4) – *Mechanics*

A uniform ladder resting in equilibrium on rough ground leans against a smooth wall. Which diagram correctly shows the forces acting on the ladder?

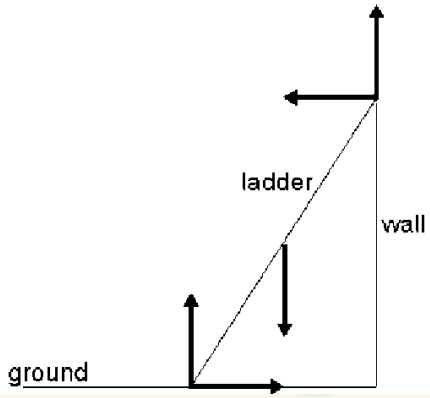
A.



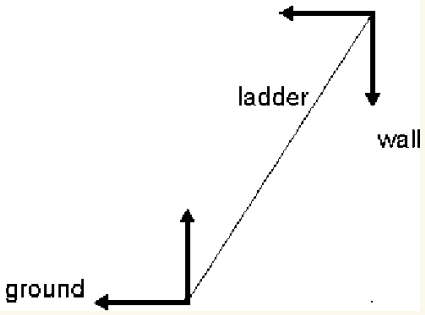
B.



C.



D.



24 – (PHYSI/11_SL_Summer_2018_Q5) – *Mechanics*

An object falls from rest from a height h close to the surface of the Moon. The Moon has no atmosphere.

When the object has fallen to height $\frac{h}{4}$ above the surface, what is

$$\frac{\text{kinetic energy of the object at } \frac{h}{4}}{\text{gravitational potential energy of the object at } h} ?$$

A. $\frac{3}{4}$

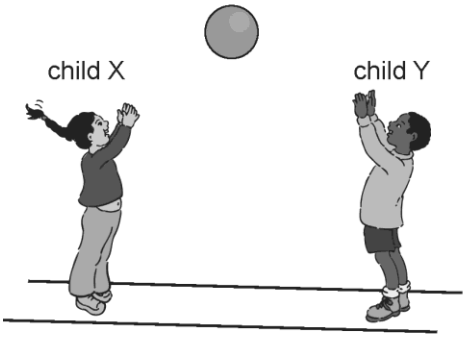
B. $\frac{4}{3}$

C. $\frac{9}{16}$

D. $\frac{16}{9}$

25 – (PHYSI/11_SL_Summer_2018_Q6) – *Mechanics*

Child X throws a ball to child Y. The system consists of the ball, the children and the Earth. What is true for the system when the ball has been caught by Y?



[Source: https://pixabay.com/en/playing-ball-kids-boy-girl-31339/]

A. The momentum of child Y is equal and opposite to the momentum of child X.

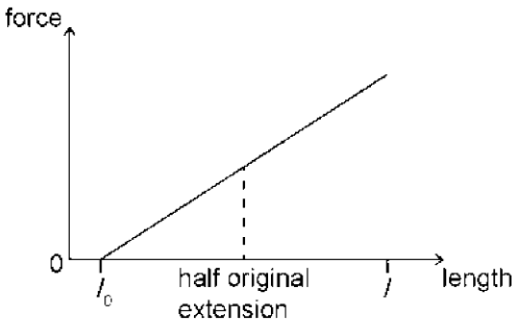
B. The speed of rotation of the Earth will have changed.

C. The ball has no net momentum while it is in the air.

D. The total momentum of the system has not changed.

26 – (PHYSI/11_SL_Summer_2018_Q7) – *Mechanics*

An increasing force acts on a metal wire and the wire extends from an initial length l_0 to a new length l. The graph shows the variation of force with length for the wire. The energy required to extend the wire from l_0 to l is E.



The wire then contracts to half its original extension.

What is the work done by the wire as it contracts?

A. 0.25E

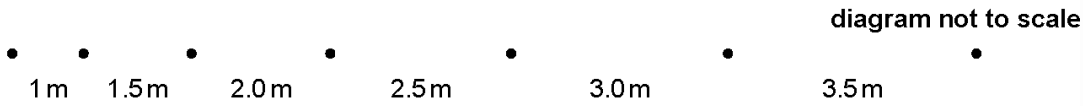
B. 0.50E

C. 0.75E

D. E

27 – (PHYSI/11_SL_Summer_2018_Q8) – *Mechanics*

The distances between successive positions of a moving car, measured at equal time intervals, are shown.



The car moves with

A. acceleration that increases linearly with time.

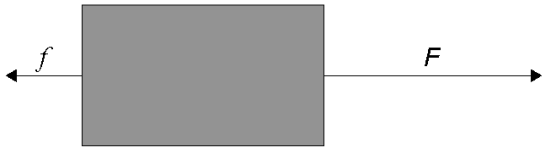
B. acceleration that increases non-linearly with time.

C. constant speed.

D. constant acceleration.

28 – (PHYSI/11_SL_Summer_2018_Q9) – *Mechanics*

An object is moving in a straight line. A force F and a resistive force f act on the object along the straight line.



Both forces act for a time t.

What is the rate of change of momentum with time of the object during time t?

A. $F+f$

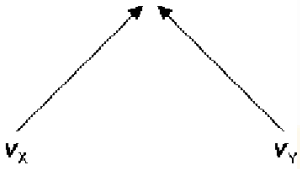
B. $F-f$

C. $(F+f)t$

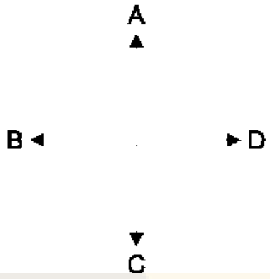
D. $(F-f)t$

29 – (PHYSI/12_SL_Summer_2018_Q2) – *Mechanics*

The velocities v_X and v_Y of two boats, X and Y, are shown.



Which arrow represents the direction of the vector $v_X - v_Y$?



30 – (PHYSI/12_SL_Summer_2018_Q3) – *Mechanics*

A motor of input power 160 W raises a mass of 8.0 kg vertically at a constant speed of 0.50 m s^{-1}. What is the efficiency of the system?

A. 0.63 %

B. 25 %

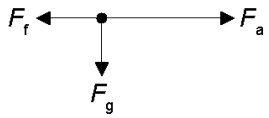
C. 50 %

D. 100 %

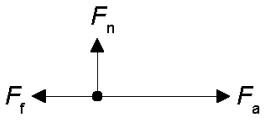
31 – (PHYSI/12_SL_Summer_2018_Q4) – *Mechanics*

A box is accelerated to the right across rough ground by a horizontal force F_a. The force of friction is F_f. The weight of the box is F_g and the normal reaction is F_n. Which is the free-body diagram for this situation?

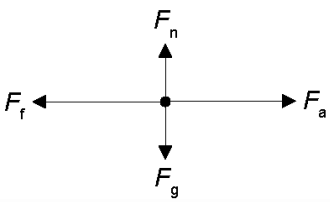
A.



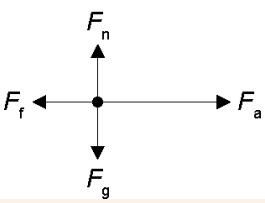
B.



C.

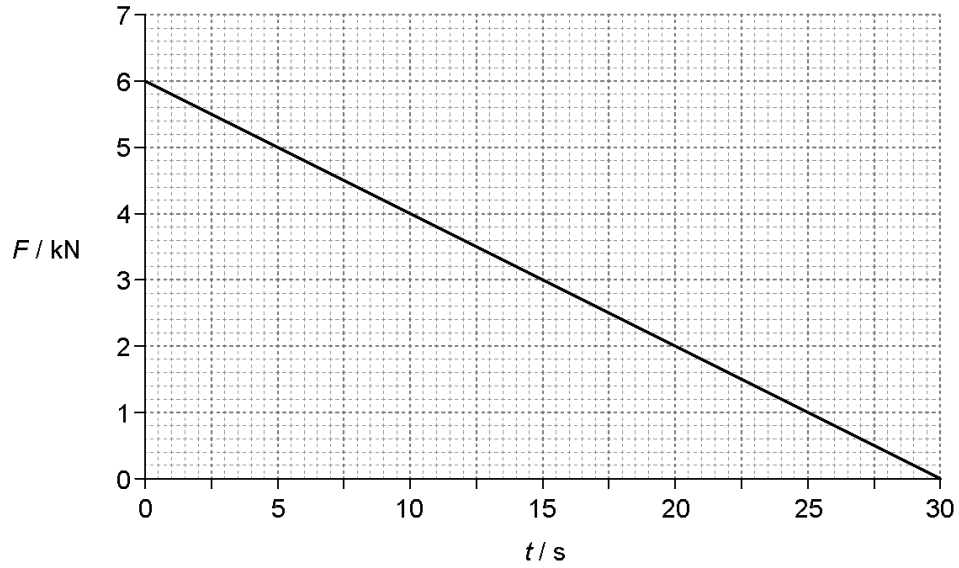


D.



32 – (PHYSI/12_SL_Summer_2018_Q5) – *Mechanics*

The graph shows the variation with time t of the force F acting on an object of mass 15000 kg. The object is at rest at $t = 0$.



What is the speed of the object when $t = 30$ s?

A. $0.18\ \text{m s}^{-1}$

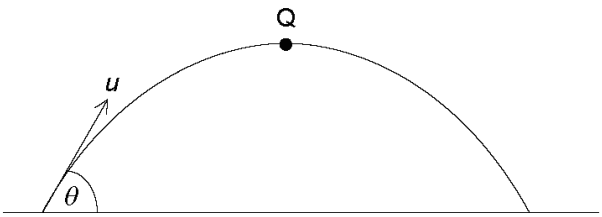
B. $6\ \text{m s}^{-1}$

C. $12\ \text{m s}^{-1}$

D. $180\ \text{m s}^{-1}$

33 – (PHYSI/12_SL_Summer_2018_Q6) – *Mechanics*

A ball of mass m is thrown with an initial speed of u at an angle θ to the horizontal as shown. Q is the highest point of the motion. Air resistance is negligible.



What is the momentum of the ball at Q?

A. zero

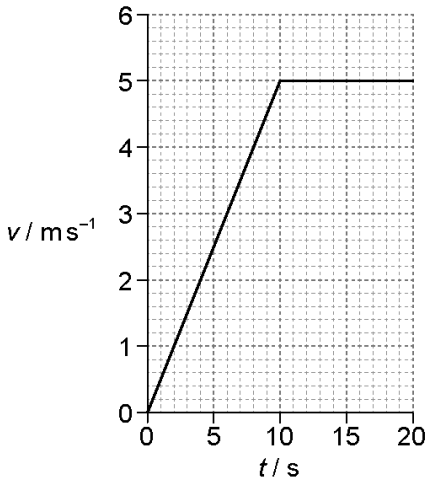
B. $mu\cos\theta$

C. mu

D. $mu\sin\theta$

34 – (PHYSI/12_SL_Summer_2018_Q7) – *Mechanics*

A boy runs along a straight horizontal track. The graph shows how his speed v varies with time t.

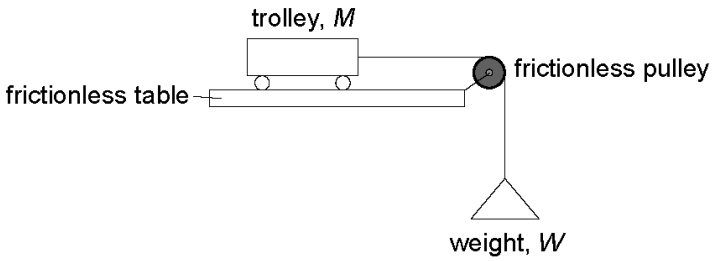


After 15 s the boy has run 50 m. What is his instantaneous speed and his average speed when $t = 15$ s?

	Instantaneous speed / m s^{-1}	Average speed / m s^{-1}
A.	3.3	3.3
B.	3.3	5.0
C.	5.0	3.3
D.	5.0	5.0

35 – (PHYSI/12_SL_Summer_2018_Q8) – *Mechanics*

A weight *W* is tied to a trolley of mass *M* by a light string passing over a frictionless pulley. The trolley has an acceleration *a* on a frictionless table. The acceleration due to gravity is *g*.



What is *W*?

A. $\frac{Mag}{(g-a)}$

B. $\frac{Mag}{(g+a)}$

C. $\frac{Ma}{(g-a)}$

D. $\frac{Ma}{(g+a)}$

36 – (PHYSI/12_SL_Summer_2018_Q9) – *Mechanics*

Two balls X and Y with the same diameter are fired horizontally with the same initial momentum from the same height above the ground. The mass of X is greater than the mass of Y. Air resistance is negligible.

What is correct about the horizontal distances travelled by X and Y and the times taken by X and Y to reach the ground?

	Horizontal distances	Time to reach ground
A.	X and Y the same	X and Y times the same
B.	X and Y the same	X takes a shorter time than Y
C.	X less than Y	X and Y times the same
D.	X less than Y	X takes a shorter time than Y

37 – (PHYSI/12_SL_Summer_2018_Q10) – *Mechanics*

Which is a unit of force?

A. $J\,m$

B. $J\,m^{-1}$

C. $J\,m\,s^{-1}$

D. $J\,m^{-1}\,s$

38 – (PHYSI/10_SL_Winter_2018_Q3) – *Mechanics*

A truck has an initial speed of $20\ m\,s^{-1}$. It decelerates at $4.0\ m\,s^{-2}$. What is the distance taken by the truck to stop?

A. 2.5 m

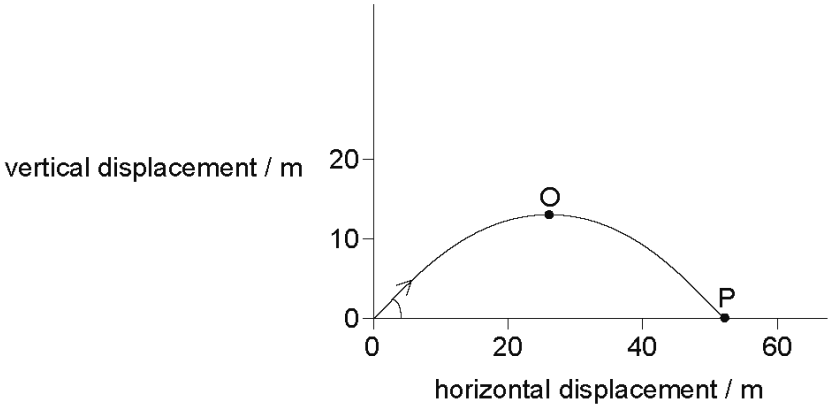
B. 5.0 m

C. 50 m

D. 100 m

39 – (PHYSI/10_SL_Winter_2018_Q4) – *Mechanics*

A projectile is fired at an angle to the horizontal. Air resistance is negligible. The path of the projectile is shown.



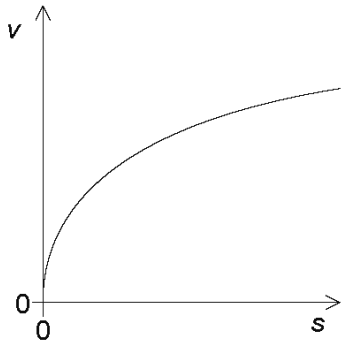
Which gives the magnitude of the horizontal component and the magnitude of the vertical component of the velocity of the projectile between O and P?

	Magnitude of horizontal component of velocity	Magnitude of vertical component of velocity
A.	constant	increases
B.	constant	constant
C.	increases	increases
D.	increases	constant

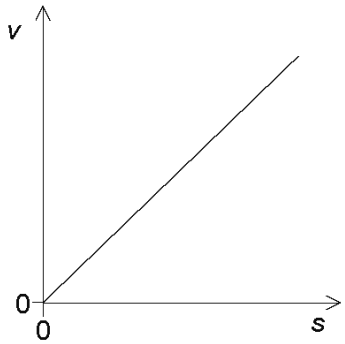
40 – (PHYSI/10_SL_Winter_2018_Q5) – *Mechanics*

A runner starts from rest and accelerates at a constant rate throughout a race. Which graph shows the variation of speed *v* of the runner with distance travelled *s*?

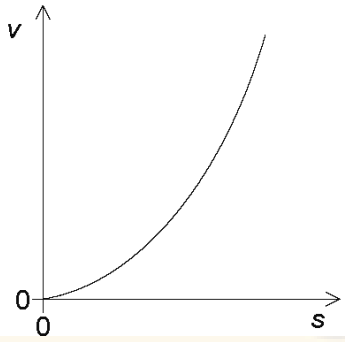
A.



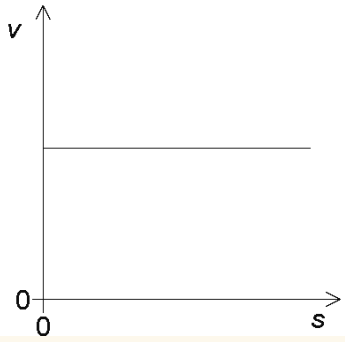
B.



C.

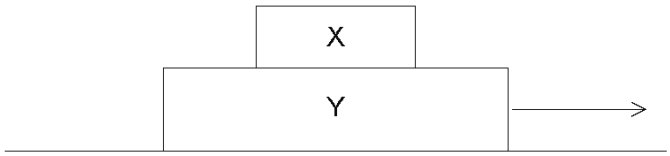


D.



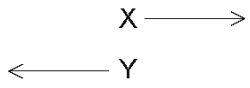
41 – (PHYSI/10_SL_Winter_2018_Q6) – *Mechanics*

Two blocks X and Y rest on a frictionless horizontal surface as shown. A horizontal force is now applied to the larger block and the two blocks move together with the same speed and acceleration.

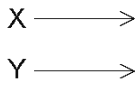


Which free-body diagram shows the frictional forces between the two blocks?

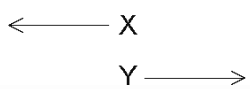
A.



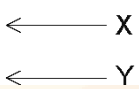
B.



C.

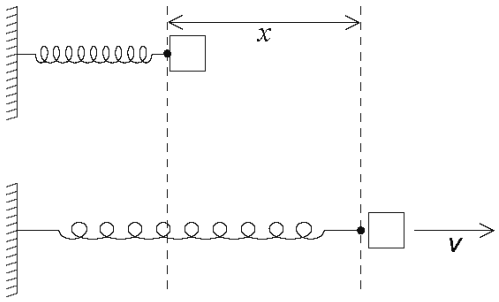


D.



42 – (PHYSI/10_SL_Winter_2018_Q8) – *Mechanics*

A compressed spring is used to launch an object along a horizontal frictionless surface. When the spring is compressed through a distance x and released, the object leaves the spring at speed v. What is the distance through which the spring must be compressed for the object to leave the spring at $\frac{v}{2}$?



A. $\frac{x}{4}$

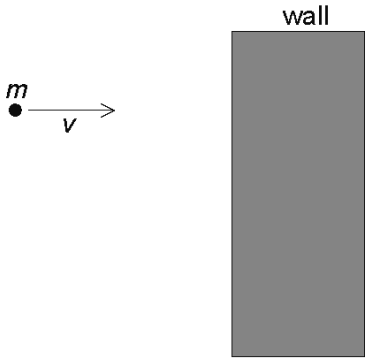
B. $\frac{x}{2}$

C. $\frac{x}{\sqrt{2}}$

D. $x\sqrt{2}$

43 – (PHYSI/10_SL_Winter_2018_Q9) – *Mechanics*

A ball of mass *m* collides with a wall and bounces back in a straight line. The ball loses 75 % of the initial energy during the collision. The speed before the collision is *v*.



What is the magnitude of the impulse on the ball by the wall?

A. $\left(1-\frac{\sqrt{3}}{2}\right)mv$

B. $\frac{1}{2}mv$

C. $\frac{5}{4}mv$

D. $\frac{3}{2}mv$

44 – (PHYSI/11_SL_Summer_2019_Q3) – *Mechanics*

A sky diver is falling at terminal speed when she opens her parachute. What are the direction of her velocity vector and the direction of her acceleration vector before she reaches the new terminal speed?

	Direction of velocity vector	Direction of acceleration vector
A.	upwards	upwards
B.	upwards	downwards
C.	downwards	upwards
D.	downwards	downwards

45 – (PHYSI/11_SL_Summer_2019_Q4) – *Mechanics*

A stone is thrown downwards from the edge of a cliff with a speed of $5.0\,m\,s^{-1}$. It hits the ground 2.0 s later. What is the height of the cliff?

A. 20 m

B. 30 m

C. 40 m

D. 50 m

46 – (PHYSI/11_SL_Summer_2019_Q5) – *Mechanics*

A ball is thrown upwards at an angle to the horizontal. Air resistance is negligible. Which statement about the motion of the ball is correct?

A. The acceleration of the ball changes during its flight.

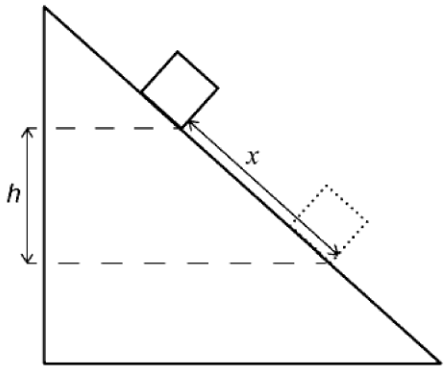
B. The velocity of the ball changes during its flight.

C. The acceleration of the ball is zero at the highest point.

D. The velocity of the ball is zero at the highest point.

47 – (PHYSI/11_SL_Summer_2019_Q6) – *Mechanics*

An object of mass m is sliding down a ramp at constant speed. During the motion it travels a distance x along the ramp and falls through a vertical distance h. The coefficient of dynamic friction between the ramp and the object is μ. What is the total energy transferred into thermal energy when the object travels distance x?



A. mgh

B. mgx

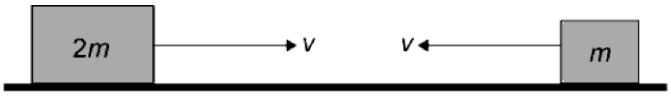
C. μmgh

D. μmgx

48 – (PHYSI/11_SL_Summer_2019_Q7) – *Mechanics*

Two blocks of masses m and $2m$ are travelling directly towards each other. Both are moving at the same constant speed v. The blocks collide and stick together.

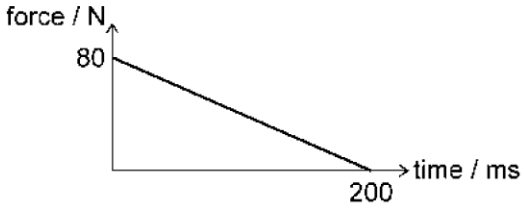
What is the total momentum of the system before and after the collision?



	Momentum before	Momentum after
A.	mv	mv
B.	mv	$-mv$
C.	$3mv$	$-3mv$
D.	$3mv$	$3mv$

49 – (PHYSI/11_SL_Summer_2019_Q8) – *Mechanics*

The graph shows the variation with time of the resultant net force acting on an object. The object has a mass of 1 kg and is initially at rest.



What is the velocity of the object at a time of 200 ms?

A. $8\ \text{m s}^{-1}$

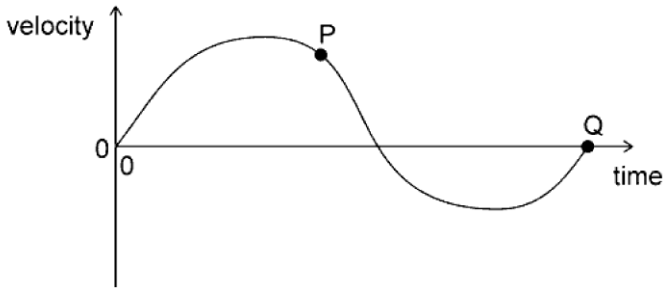
B. $16\ \text{m s}^{-1}$

C. $8\ \text{km s}^{-1}$

D. $16\ \text{km s}^{-1}$

50 – (PHYSI/12_SL_Summer_2019_Q3) – *Mechanics*

The graph shows the variation of velocity of a body with time along a straight line.



What is correct for this graph?

A. The maximum acceleration is at P.

B. The average acceleration of the body is given by the area enclosed by the graph and time axis.

C. The maximum displacement is at Q.

D. The total displacement of the body is given by the area enclosed by the graph and time axis.

51 – (PHYSI/12_SL_Summer_2019_Q4) – *Mechanics*

Two forces of magnitude 12 N and 24 N act at the same point. Which force **cannot** be the resultant of these forces?

A. 10 N

B. 16 N

C. 19 N

D. 36 N

52 – (PHYSI/12_SL_Summer_2019_Q5) – *Mechanics*

An object has a weight of 6.10×10^2 N. What is the change in gravitational potential energy of the object when it moves through 8.0 m vertically?

A. 5 kJ

B. 4.9 kJ

C. 4.88 kJ

D. 4.880 kJ

53 – (PHYSI/12_SL_Summer_2019_Q7) – *Mechanics*

An astronaut is moving at a constant velocity in the absence of a gravitational field when he throws a tool away from him.

What is the effect of throwing the tool on the total kinetic energy of the astronaut and the tool and the total momentum of the astronaut and the tool?

	Total kinetic energy of the astronaut and tool	Total momentum of the astronaut and tool
A.	no change	increases
B.	no change	no change
C.	increases	increases
D.	increases	no change

54 – (PHYSI/12_SL_Summer_2019_Q8) – *Mechanics*

A table-tennis ball of mass 3 g is fired with a speed of $10\,m\,s^{-1}$ from a stationary toy gun of mass 0.600 kg. The gun and ball are an isolated system.

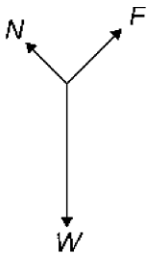
What are the recoil speed of the toy gun and the total momentum of the system immediately after the gun is fired?

	Recoil speed of the toy gun / $m\,s^{-1}$	Total momentum of the system / $kg\,m\,s^{-1}$
A.	0.05	0
B.	0.05	0.03
C.	0.5	0
D.	0.5	0.03

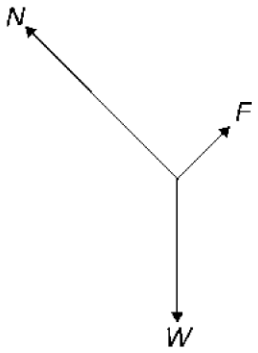
55 – (PHYSI/12_SL_Summer_2019_Q9) – *Mechanics*

A block of weight *W* slides down a ramp at constant velocity. A friction force *F* acts between the bottom of the block and the surface of the ramp. A normal reaction *N* acts between the ramp and the block. What is the free-body diagram for the forces that act on the block?

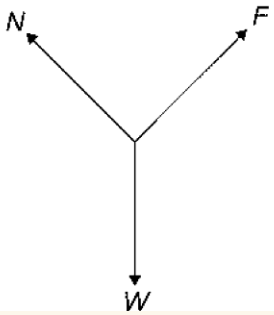
A.



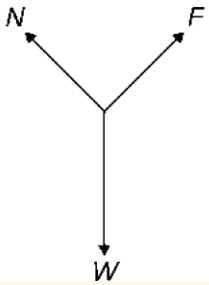
B.



C.

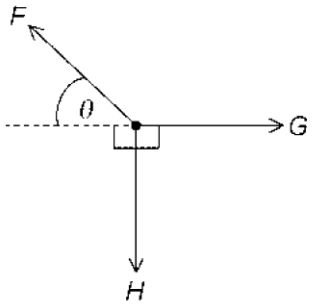


D.



56 – (PHYSI/10_SL_Winter_2019_Q2) – *Mechanics*

An object is held in equilibrium by three forces of magnitude F, G and H that act at a point in the same plane.



Three equations for these forces are

I. $F\cos\theta = G$
II. $F = G\cos\theta + H\sin\theta$
III. $F = G + H$

Which equations are correct?

A. I and II only

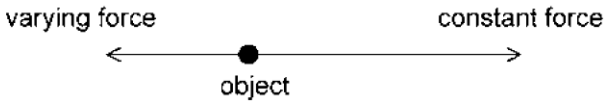
B. I and III only

C. II and III only

D. I, II and III

57 – (PHYSI/10_SL_Winter_2019_Q3) – *Mechanics*

Two forces act along a straight line on an object that is initially at rest. One force is constant; the second force is in the opposite direction and proportional to the velocity of the object.



What is correct about the motion of the object?

A. The acceleration increases from zero to a maximum.

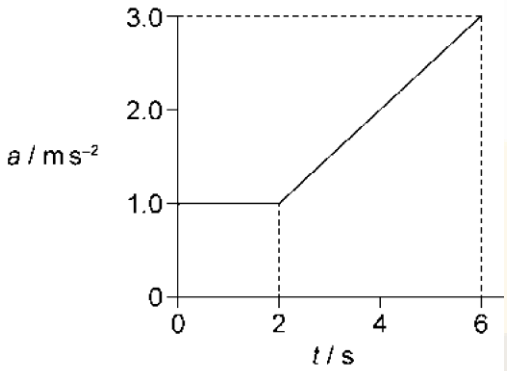
B. The acceleration increases from zero to a maximum and then decreases.

C. The velocity increases from zero to a maximum.

D. The velocity increases from zero to a maximum and then decreases.

58 – (PHYSI/10_SL_Winter_2019_Q4) – *Mechanics*

The variation with time t of the acceleration a of an object is shown.



What is the change in velocity of the object from $t = 0$ to $t = 6\,s$?

A. $6\,m\,s^{-1}$

B. $8\,m\,s^{-1}$

C. $10\,m\,s^{-1}$

D. $14\,m\,s^{-1}$

59 – (PHYSI/10_SL_Winter_2019_Q5) – *Mechanics*

A climber of mass m slides down a vertical rope with an average acceleration a. What is the average frictional force exerted by the rope on the climber?

A. mg

B. $m(g + a)$

C. $m(g - a)$

D. ma

60 – (PHYSI/10_SL_Winter_2019_Q6) – *Mechanics*

A cube slides down the surface of a ramp at a constant velocity. What is the magnitude of the frictional force that acts on the cube due to the surface?

A. The weight of the cube

B. The component of weight of the cube parallel to the plane

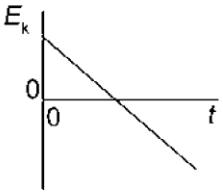
C. The component of weight of the cube perpendicular to the plane

D. The component of the normal reaction at the surface parallel to the plane

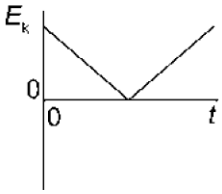
61 – (PHYSI/10_SL_Winter_2019_Q7) – *Mechanics*

A ball is thrown vertically upwards. Air resistance is negligible. What is the variation with time t of the kinetic energy E_k of the ball?

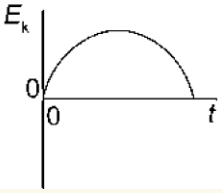
A.



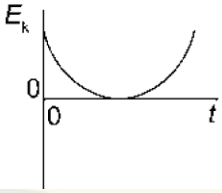
B.



C.



D.



62 – (PHYSI/10_SL_Winter_2019_Q8) – *Mechanics*

The tension in a horizontal spring is directly proportional to the extension of the spring. The energy stored in the spring at extension x is E. What is the work done by the spring when its extension changes from x to $\frac{x}{4}$?

A. $\frac{E}{16}$

B. $\frac{E}{4}$

C. $\frac{3E}{4}$

D. $\frac{15E}{16}$

63 – (PHYSI/10_SL_Winter_2020_Q3) – *Mechanics*

An object of mass $2m$ moving at velocity $3v$ collides with a stationary object of mass $4m$. The objects stick together after the collision. What is the final speed and the change in total kinetic energy immediately after the collision?

	Final speed	Change in total kinetic energy
A.	v	$3\,mv^2$
B.	v	$6\,mv^2$
C.	$2v$	$3\,mv^2$
D.	$2v$	$6\,mv^2$

64 – (PHYSI/10_SL_Winter_2020_Q4) – *Mechanics*

An object of mass 1 kg is thrown downwards from a height of 20 m. The initial speed of the object is $6\,m\,s^{-1}$.
The object hits the ground at a speed of $20\,m\,s^{-1}$. Assume $g = 10\,m\,s^{-2}$. What is the best estimate of the energy transferred from the object to the air as it falls?

A. 6 J

B. 18 J

C. 182 J

D. 200 J

65 – (PHYSI/10_SL_Winter_2020_Q5) – *Mechanics*

An object of mass 8.0 kg is falling vertically through the air. The drag force acting on the object is 60 N. What is the best estimate of the acceleration of the object?

A. Zero

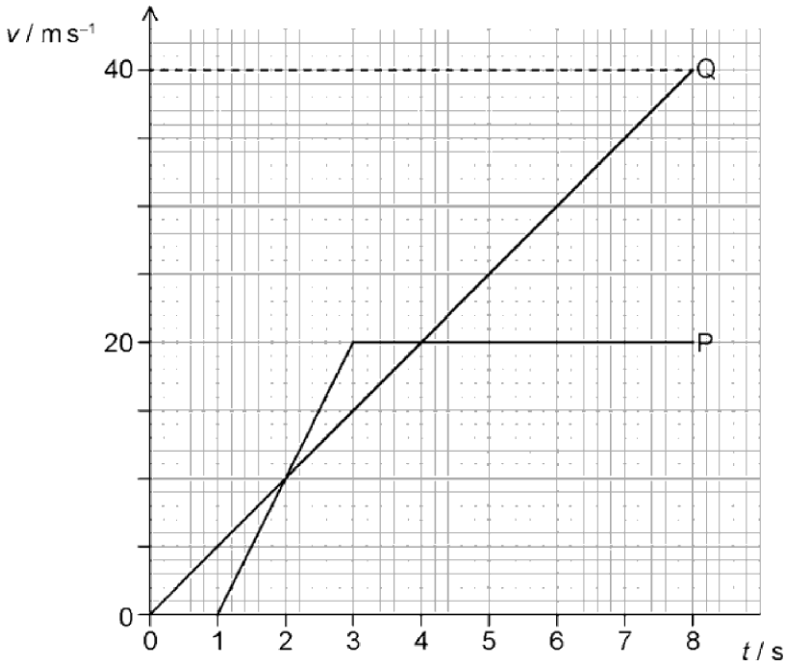
B. $2.5\,m\,s^{-2}$

C. $7.5\,m\,s^{2}$

D. $10\,m\,s^{-2}$

66 – (PHYSI/10_SL_Winter_2020_Q6) – *Mechanics*

P and Q leave the same point, travelling in the same direction. The graphs show the variation with time t of velocity v for both P and Q.



What is the distance between P and Q when $t = 8.0\,s$?

A. 20 m

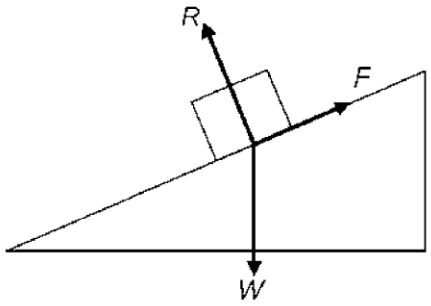
B. 40 m

C. 60 m

D. 120 m

67 – (PHYSI/10_SL_Winter_2020_Q7) – *Mechanics*

Three forces act on a block which is sliding down a slope at constant speed. W is the weight, R is the reaction force at the surface of the block and F is the friction force acting on the block.



In this situation

A. there must be an unbalanced force down the plane.

B. $W = R$.

C. $F - W$.

D. the resultant force on the block is zero.

68 – (PHYSI/10_SL_Winter_2020_Q8) – *Mechanics*

A balloon rises at a steady vertical velocity of $10\,\text{m}\,\text{s}^{-1}$. An object is dropped from the balloon at a height of 40 m above the ground. Air resistance is negligible. What is the time taken for the object to hit the ground?

A. 10 s

B. 5 s

C. 4 s

D. 2 s

69 – (PHYSI/10_SL_Winter_2020_Q9) – *Mechanics*

An object of mass m strikes a vertical wall horizontally at speed U. The object rebounds from the wall horizontally at speed V.
What is the magnitude of the change in the momentum of the object?

A. 0

B. $m(V-U)$

C. $m(U-V)$

D. $m(U+V)$

70 – (PHYSI/10_SL_Winter_2020_Q10) – *Mechanics*

A horizontal force F acts on a sphere. A horizontal resistive force kv^2 acts on the sphere where v is the speed of the sphere and k is a constant. What is the terminal velocity of the sphere?

A. $\sqrt{\frac{k}{F}}$

B. $\frac{k}{F}$

C. $\frac{F}{k}$

D. $\sqrt{\frac{F}{k}}$

71 – (PHYSI/11_SL_Summer_2021_Q3) – *Mechanics*

A large stone is dropped from a tall building. What is correct about the speed of the stone after 1 s?

A. It is decreasing at increasing rate.

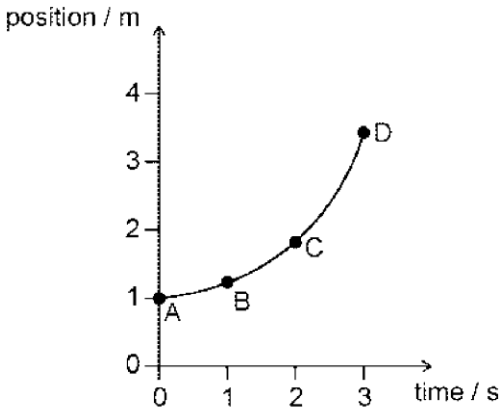
B. It is decreasing at decreasing rate.

C. It is increasing at increasing rate.

D. It is increasing at decreasing rate.

72 – (PHYSI/11_SL_Summer_2021_Q4) – *Mechanics*

The graph shows how the position of an object varies with time in the interval from 0 to 3 s.



At which point does the instantaneous speed of the object equal its average speed over the interval from 0 to 3 s?

73 – (PHYSI/11_SL_Summer_2021_Q5) – *Mechanics*

A car takes 20 minutes to climb a hill at constant speed. The mass of the car is 1200 kg and the car gains gravitational potential energy at a rate of 6.0 kW. Take the acceleration of gravity to be $10\,m\,s^{-2}$. What is the height of the hill?

A. 0.6 m

B. 10 m

C. 600 m

D. 6000 m

74 – (PHYSI/11_SL_Summer_2021_Q6) – *Mechanics*

A ball undergoes an elastic collision with a vertical wall. Which of the following is equal to zero?

A. The change of the magnitude of linear momentum of the ball

B. The magnitude of the change of linear momentum of the ball

C. The rate of change of linear momentum of the ball

D. The impulse of the force on the ball

75 – (PHYSI/11_SL_Summer_2021_Q7) – *Mechanics*

Two forces act on an object in different directions. The magnitudes of the forces are 18 N and 27 N. The mass of the object is 9.0 kg. What is a possible value for the acceleration of the object?

A. $0\,m\,s^{-2}$

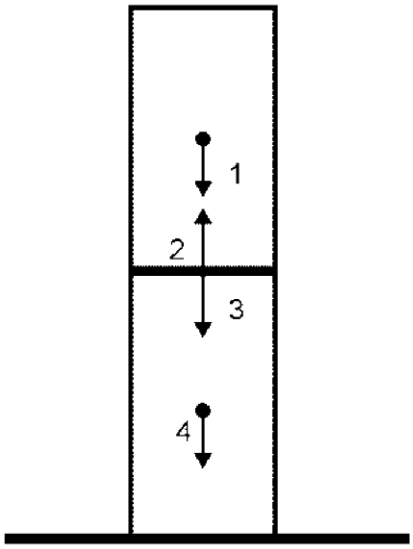
B. $0.5\,m\,s^{-2}$

C. $2.0\,m\,s^{-2}$

D. $6.0\,m\,s^{-2}$

76 – (PHYSI/11_SL_Summer_2021_Q8) – *Mechanics*

Two identical boxes are stored in a warehouse as shown in the diagram. Two forces acting on the top box and two forces acting on the bottom box are shown.



Which is a force pair according to Newton's third law?

A. 1 and 2

B. 3 and 4

C. 2 and 3

D. 2 and 4

77 – (PHYSI/11_SL_Summer_2021_Q9) – *Mechanics*

An electron has a linear momentum of $4.0 \times 10^{-25}\,\text{kg m s}^{-1}$. What is the order of magnitude of the kinetic energy of the electron?

A. $10^{-50}\,\text{J}$

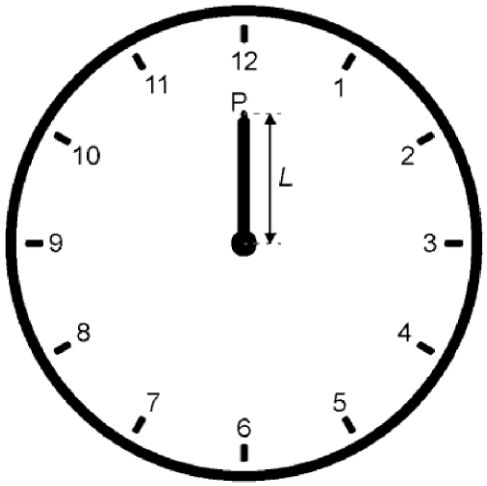
B. $10^{-34}\,\text{J}$

C. $10^{-19}\,\text{J}$

D. $10^{6}\,\text{J}$

78 – (PHYSI/12_SL_Summer_2021_Q3) – *Mechanics*

The minute hand of a clock hanging on a vertical wall has length $L = 30\,\text{cm}$.



The minute hand is observed pointing at 12 and then again 30 minutes later when the minute hand is pointing at 6.

What is the average velocity and average speed of point P on the minute hand during this time interval?

	Average velocity	Average speed
A.	$2\,\text{cm min}^{-1}$ vertically downwards	$\pi\,\text{cm min}^{-1}$
B.	$2\,\text{cm min}^{-1}$ vertically upwards	$\pi\,\text{cm min}^{-1}$
C.	$2\pi\,\text{cm min}^{-1}$ vertically downwards	$2\pi\,\text{cm min}^{-1}$
D.	$2\pi\,\text{cm min}^{-1}$ vertically upwards	$2\pi\,\text{cm min}^{-1}$

79 – (PHYSI/12_SL_Summer_2021_Q4) – *Mechanics*

A person is standing at rest on the ground and experiences a downward gravitational force W and an upward normal force from the ground N. Which, according to Newton's third law, is the force that together with W forms a force pair?

A. The gravitational force W acting upwards on the ground.

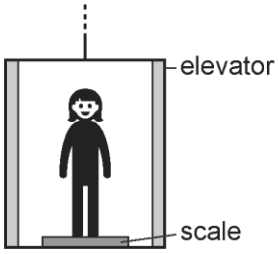
B. The gravitational force W acting upwards on the person.

C. The normal force N acting upwards on the person.

D. The normal force N acting downwards on the ground.

80 – (PHYSI/12_SL_Summer_2021_Q5) – *Mechanics*

A person with a weight of 600 N stands on a scale in an elevator.



What is the acceleration of the elevator when the scale reads 900 N?

A. $5.0\,m\,s^{-2}$ downwards

B. $1.5\,m\,s^{-2}$ downwards

C. $1.5\,m\,s^{-2}$ upwards

D. $5.0\,m\,s^{-2}$ upwards

81 – (PHYSI/12_SL_Summer_2021_Q6) – *Mechanics*

Two identical boxes containing different masses are sliding with the same initial speed on the same horizontal surface. They both come to rest under the influence of the frictional force of the surface. How do the frictional force and acceleration of the boxes compare?

	Frictional force	Acceleration
A.	different	different
B.	different	equal
C.	equal	different
D.	equal	equal

82 – (PHYSI/12_SL_Summer_2021_Q7) – *Mechanics*

Two identical blocks, each of mass m and speed v, travel towards each other on a frictionless surface.

The blocks undergo a head-on collision. What is definitely true **immediately** after the collision?

A. The momentum of each block is zero.

B. The total momentum is zero.

C. The momentum of each block is $2mv$.

D. The total momentum is $2mv$.

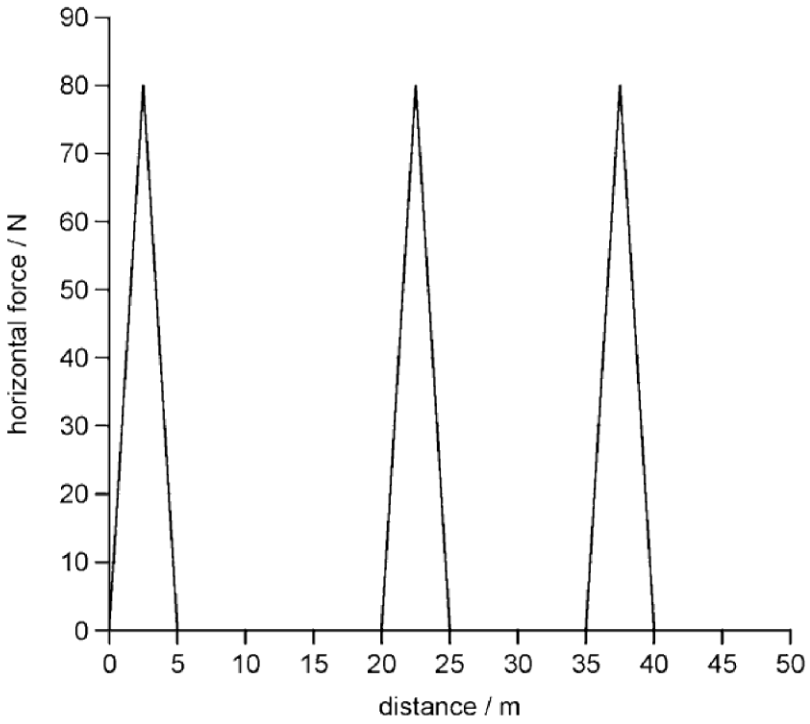
83 – (PHYSI/12_SL_Summer_2021_Q8) – *Mechanics*

A projectile is launched upwards at an angle θ to the horizontal with an intial momentum p_0 and an initial energy E_0. Air resistance is negligible. What are the momentum and total energy of the projectile at the highest point of the motion?

	Momentum	Energy
A.	$< p_0$	E_0
B.	p_0	E_0
C.	p_0	$< E_0$
D.	$< p_0$	$< E_0$

84 – (PHYSI/12_SL_Summer_2021_Q9) – *Mechanics*

The graph shows the variation with distance of a horizontal force acting on an object. The object, initially at rest, moves horizontally through a distance of 50 m.



A constant frictional force of 2.0 N opposes the motion. What is the final kinetic energy of the object after it has moved 50 m?

A. 100 J

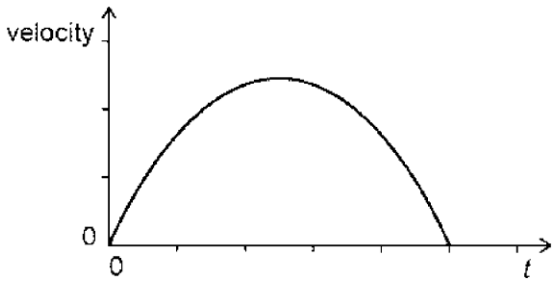
B. 500 J

C. 600 J

D. 1100 J

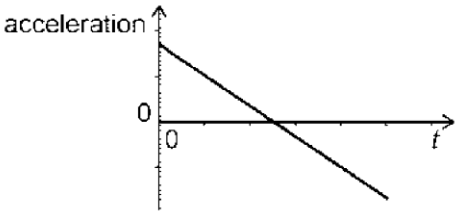
85 – (PHYSI/10_SL_Winter_2021_Q3) – *Mechanics*

The graph shows the variation with time t of the velocity of an object.

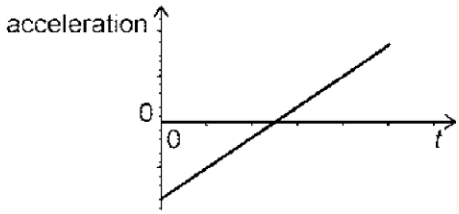


What is the variation with time t of the acceleration of the object?

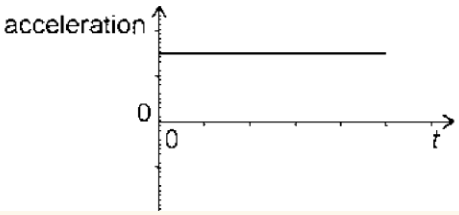
A.



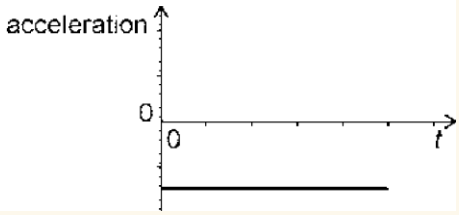
B.



C.



D.



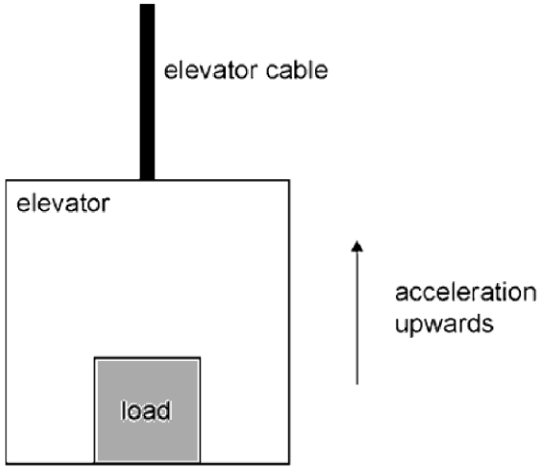
86 – (PHYSI/10_SL_Winter_2021_Q4) – *Mechanics*

A ball is thrown vertically downwards with an initial speed of $4.0\,m\,s^{-1}$. The ball hits the ground with a speed of $16\,m\,s^{-1}$. Air resistance is negligible. What is the time of fall and what is the distance travelled by the ball?

	Time of fall / s	Distance / m
A.	1.0	10
B.	1.0	12
C.	1.2	10
D.	1.2	12

87 – (PHYSI/10_SL_Winter_2021_Q5) – *Mechanics*

An elevator (lift) and its load accelerate vertically upwards.



Which statement is correct in this situation?

A. The net force on the load is zero.

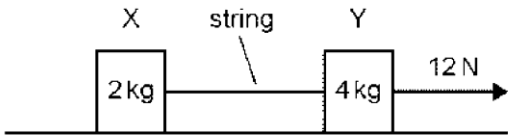
B. The tension in the cable is equal but opposite to the combined weight of the elevator and its load.

C. The normal reaction force on the load is equal but opposite to the force on the elevator from the load.

D. The elevator and its load are in translational equilibrium.

88 – (PHYSI/10_SL_Winter_2021_Q6) – *Mechanics*

X and Y are two objects on a frictionless table connected by a string. The mass of X is 2 kg and the mass of Y is 4 kg. The mass of the string is negligible. A constant horizontal force of 12 N acts on Y.

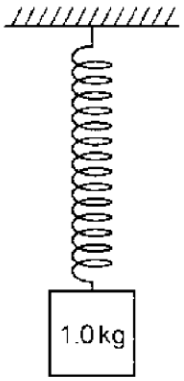


What are the acceleration of Y and the magnitude of the tension in the string?

	Acceleration of Y / m s $^{-2}$	Tension in the string / N
A.	2	4
B.	2	6
C.	3	4
D.	3	6

89 – (PHYSI/10_SL_Winter_2021_Q7) – *Mechanics*

An object of mass 1.0 kg hangs at rest from a spring. The spring has a negligible mass and the spring constant k is 20 N m^{-1}



What is the elastic potential energy stored in the spring?

A. 1.0 J

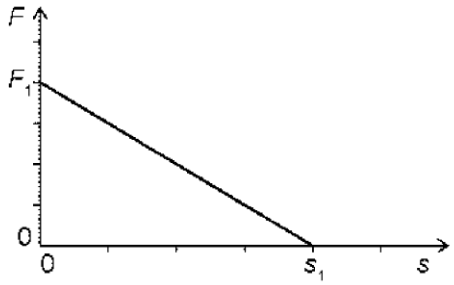
B. 2.5 J

C. 5.0 J

D. 10 J

90 – (PHYSI/10_SL_Winter_2021_Q8) – *Mechanics*

A net force F acts on an object of mass m that is initially at rest. The object moves in a straight line. The variation of F with the distance s is shown.



What is the speed of the object at the distance s_1?

A. $\sqrt{\frac{F_1 s_1}{2m}}$

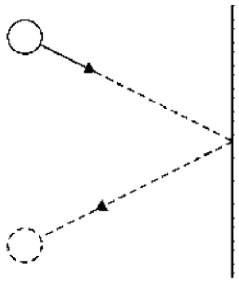
B. $\sqrt{\frac{F_1 s_1}{m}}$

C. $\sqrt{\frac{2F_1 s_1}{m}}$

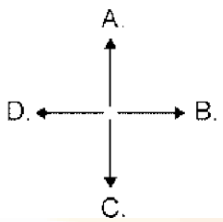
D. $\sqrt{\frac{4F_1 s_1}{m}}$

91 – (PHYSI/10_SL_Winter_2021_Q9) – *Mechanics*

A ball rolls on the floor towards a wall and rebounds with the same speed and at the same angle to the wall.



What is the direction of the impulse applied to the ball by the wall?



92 – (PHYSI/11_SL_Summer_2022_Q4) – *Mechanics*

A block moving with initial speed v is brought to rest, after travelling a distance d, by a frictional force f. A second identical block moving with initial speed u is brought to rest in the same distance d by a frictional force $\frac{f}{2}$. What is u?

A. v

B. $\frac{v}{\sqrt{2}}$

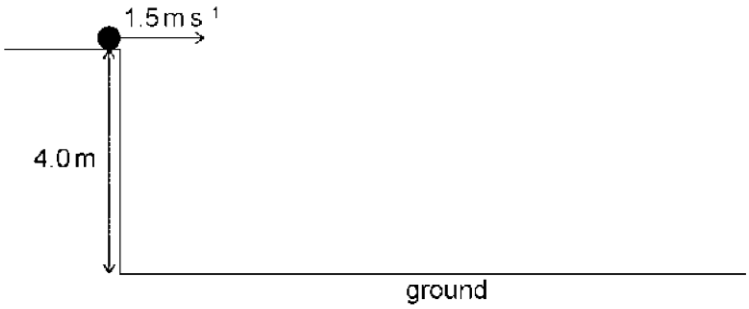
C. $\frac{v}{2}$

D. $\frac{v}{4}$

93 – (PHYSI/11_SL_Summer_2022_Q5) – *Mechanics*

A stone is kicked horizontally at a speed of $1.5\,\text{m s}^{-1}$ from the edge of a cliff on one of Jupiter's moons. It hits the ground 2.0 s later. The height of the cliff is 4.0 m.
Air resistance is negligible.

What is the magnitude of the displacement of the stone?



A. 7.0 m

B. 5.0 m

C. 4.0 m

D. 3.0 m

94 – (PHYSI/11_SL_Summer_2022_Q6) – *Mechanics*

Which of the formulae represents Newton's second law?

A. $\frac{\text{mass}}{\text{volume}}$

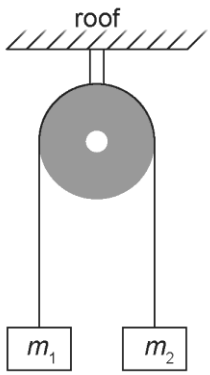
B. $\frac{\text{work}}{\text{displacement}}$

C. $\frac{\text{change of momentum}}{\text{time}}$

D. pressure × area

95 – (PHYSI/11_SL_Summer_2022_Q7) – *Mechanics*

Two masses m_1 and m_2 are connected by a string over a frictionless pulley of negligible mass. The masses are released from rest. Air resistance is negligible.



Mass m_2 accelerates downwards at $\frac{g}{2}$. What is $\frac{m_1}{m_2}$?

A. $\frac{1}{3}$

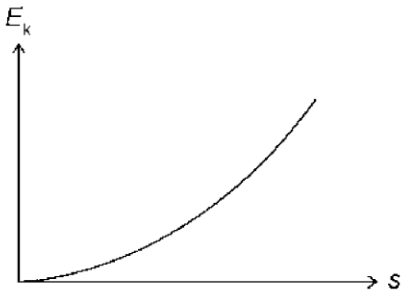
B. $\frac{1}{2}$

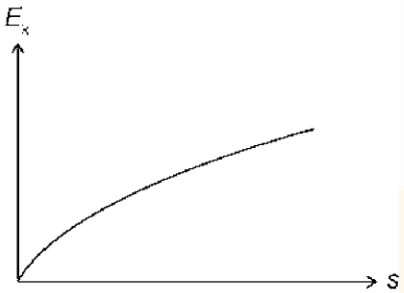
C. 2

D. 3

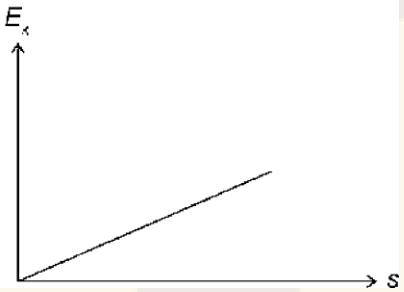
96 – (PHYSI/11_SL_Summer_2022_Q8) – *Mechanics*

A cart travels from rest along a horizontal surface with a constant acceleration. What is the variation of the kinetic energy E_k of the cart with its distance s travelled? Air resistance is negligible.

A. 

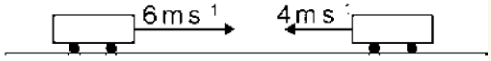
B. 

C. 

D. 

97 – (PHYSI/11_SL_Summer_2022_Q9) – *Mechanics*

Two trolleys of equal mass travel in opposite directions as shown.



The trolleys collide head-on and stick together.

What is their velocity after the collision?

A. $1\,m\,s^{-1}$

B. $2\,m\,s^{-1}$

C. $5\,m\,s^{-1}$

D. $10\,m\,s^{-1}$

98 – (PHYSI/12_SL_Summer_2022_Q4) – *Mechanics*

A car accelerates uniformly from rest to a velocity v during time t_1. It then continues at constant velocity v from t_1 to time t_2.

What is the total distance covered by the car in t_2?

A. $v\,t_2$

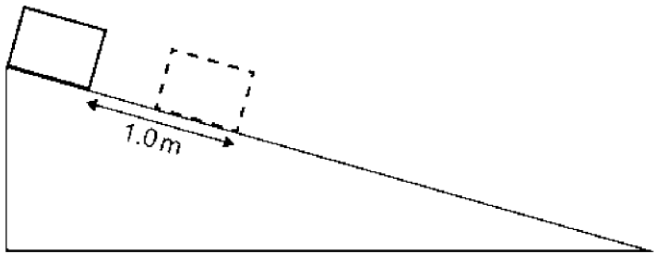
B. $\frac{1}{2}v(t_2 - t_1) + v\,t_1$

C. $\frac{1}{2}v(t_2 + t_1)$

D. $\frac{1}{2}vt_1 + v(t_2 - t_1)$

99 – (PHYSI/12_SL_Summer_2022_Q5) – *Mechanics*

An object is sliding from rest down a frictionless inclined plane. The object slides 1.0 m during the first second.



What distance will the object slide during the next second?

A. 1.0 m

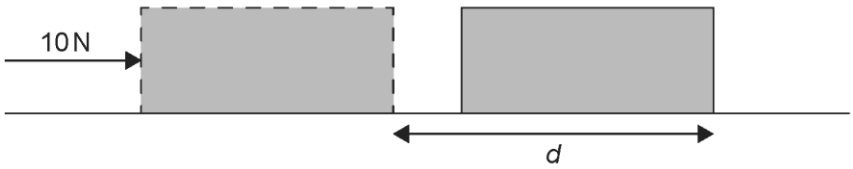
B. 2.0 m

C. 3.0 m

D. 4.9 m

100 – (PHYSI/12_SL_Summer_2022_Q6) – *Mechanics*

An object of mass 2.0 kg rests on a rough surface. A person pushes the object in a straight line with a force of 10 N through a distance *d*.



The resultant force acting on the object throughout *d* is 6.0 N.

What is the value of the sliding coefficient of friction μ between the surface and the object and what is the acceleration *a* of the object?

	μ	a / m s^{-2}
A.	0.20	3.0
B.	0.20	5.0
C.	0.40	3.0
D.	0.40	5.0

101 – (PHYSI/12_SL_Summer_2022_Q7) – *Mechanics*

A rocket has just been launched vertically from Earth. The image shows the free-body diagram of the rocket. F_1 represents a larger force than F_2.

Which force pairs with F_1 and which force pairs with F_2, according to Newton's third law?

	Force pair with F_1	Force pair with F_2
A.	force of rocket on exhaust gases	force of exhaust gases on rocket
B.	force of rocket on exhaust gases	gravitational force of rocket on Earth
C.	gravitational force of Earth on rocket	force of exhaust gases on rocket
D.	gravitational force of Earth on rocket	gravitational force of rocket on Earth

102 – (PHYSI/12_SL_Summer_2022_Q8) – *Mechanics*

An object is pushed from rest by a constant net force of 100 N. When the object has travelled 2.0 m the object has reached a velocity of 10 m s $^{-1}$.

What is the mass of the object?

A. 2 kg

B. 4 kg

C. 40 kg

D. 200 kg

103 – (PHYSI/12_SL_Summer_2022_Q9) – *Mechanics*

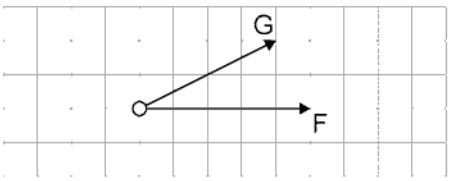
Two blocks of different masses are released from identical springs of elastic constant k – 100 N m $^{-1}$, initially compressed a distance Δx – 0.1 m. Block X has a mass of 1 kg and block Y has a mass of 0.25 kg.

What are the velocities of the blocks when they leave the springs?

	Velocity of block X	Velocity of block Y
A.	1.0 m s $^{-1}$	1.0 m s $^{-1}$
B.	2.0 m s $^{-1}$	1.0 m s $^{-1}$
C.	1.0 m s $^{-1}$	2.0 m s $^{-1}$
D.	2.0 m s $^{-1}$	2.0 m s $^{-1}$

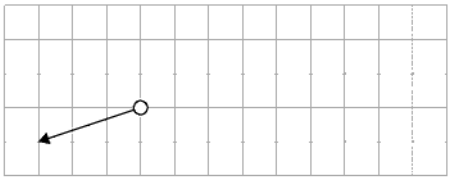
104 – (PHYSI/10_SL_Winter_2022_Q2) – *Mechanics*

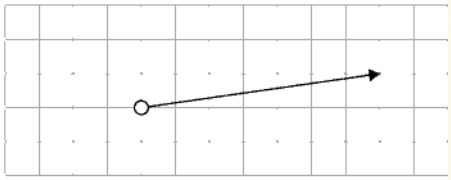
Two forces, F and G, act on a system.

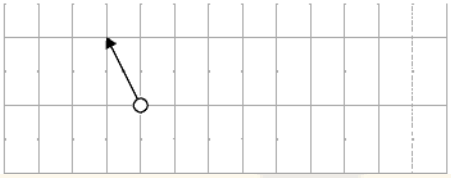


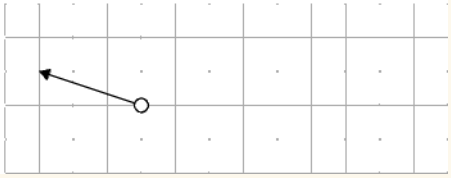
F is reversed in direction and G is halved.

Which vector correctly represents the new resultant force?

A. 

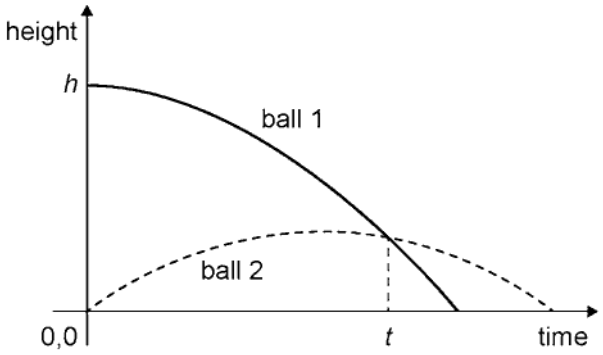
B. 

C. 

D. 

105 – (PHYSI/10_SL_Winter_2022_Q3) – *Mechanics*

Ball 1 is dropped from rest from an initial height *h*. At the same instant, ball 2 is launched vertically upwards at an initial velocity *u*.



At what time are both balls at the same distance above the ground?

A. $\frac{h}{4u}$

B. $\frac{h}{2u}$

C. $\frac{h}{u}$

D. $\frac{2h}{u}$

106 – (PHYSI/10_SL_Winter_2022_Q4) – *Mechanics*

A projectile is launched with a velocity *u* at an angle θ to the horizontal. It reaches a maximum height *s*. What is the time taken to reach the maximum height?

A. $\frac{2s}{u\cos\theta}$

B. $\frac{2s}{g}$

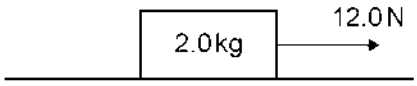
C. $\frac{u\cos\theta}{g}$

D. $\frac{u\sin\theta}{g}$

107 – (PHYSI/10_SL_Winter_2022_Q5) – *Mechanics*

An object of mass 2.0 kg is on a horizontal surface. The object is pulled by a force of 12.0 N and accelerates at 2.0 m s $^{-2}$.

What is the coefficient of dynamic friction between the object and the surface?



A. 0.3

B. 0.4

C. 0.6

D. 0.8

108 – (PHYSI/10_SL_Winter_2022_Q6) – *Mechanics*

A person lifts a total mass of 20 kg through a vertical distance of 0.60 m. The person repeats the lift n times to transfer a total energy of 6.0×10^4 J.

What is n?

A. 5

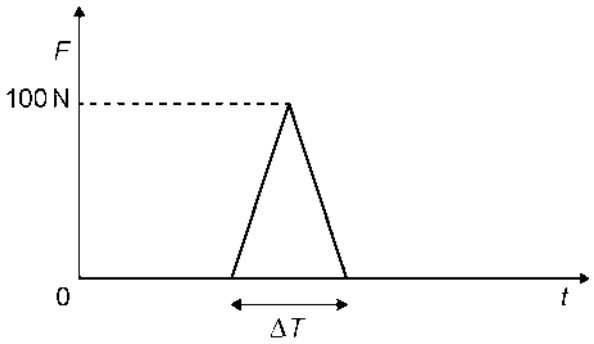
B. 50

C. 500

D. 5000

109 – (PHYSI/10_SL_Winter_2022_Q7) – *Mechanics*

A ball of mass 1.5 kg strikes a force sensor and bounces. The ball experiences a change in velocity of 10 m s $^{-1}$. The graph shows the variation with time t of the force F recorded by the sensor.



What is ΔT?

A. 0.15 s

B. 0.30 s

C. 0.60 s

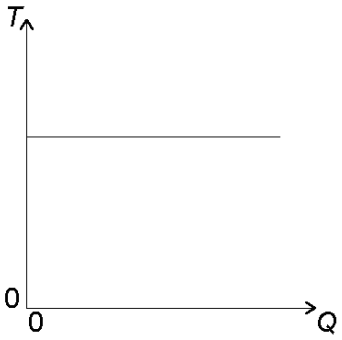
D. 3.0 s

1 – (PHYSI/11_SL_Summer_2017_Q10) – *Thermal Physics*

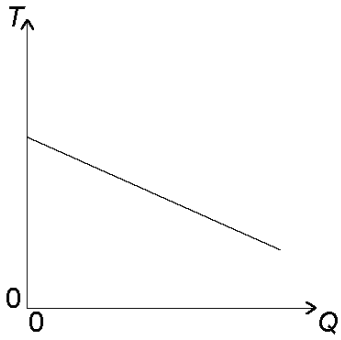
A liquid is initially at its freezing point. Energy is removed at a uniform rate from the liquid until it freezes completely.

Which graph shows how the temperature *T* of the liquid varies with the energy *Q* removed from the liquid?

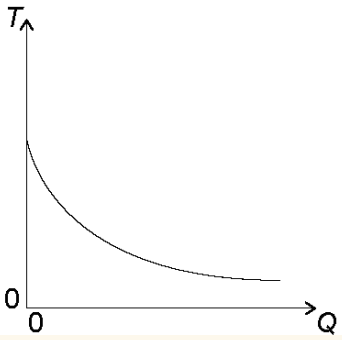
A.



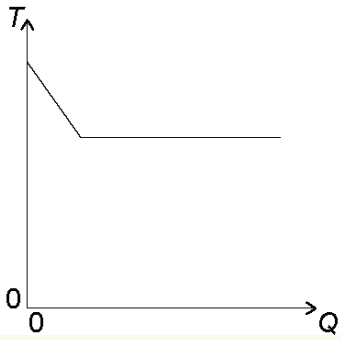
B.



C.

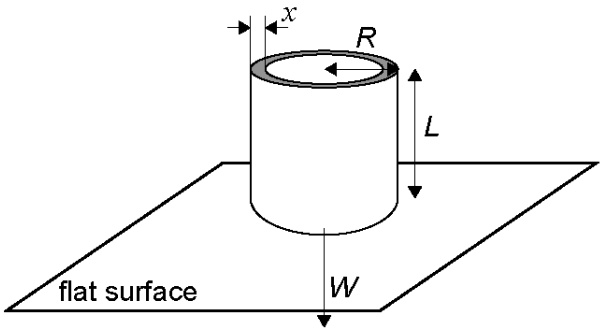


D.



2 – (PHYSI/11_SL_Summer_2017_Q11) – *Thermal Physics*

A thin-walled cylinder of weight W, open at both ends, rests on a flat surface. The cylinder has a height L, an average radius R and a thickness x where R is much greater than x.



What is the pressure exerted by the cylinder walls on the flat surface?

A. $\frac{W}{2\pi Rx}$

B. $\frac{W}{\pi R^2 x}$

C. $\frac{W}{\pi R^2}$

D. $\frac{W}{\pi R^2 L}$

3 – (PHYSI/11_SL_Summer_2017_Q12) – *Thermal Physics*

A fixed mass of an ideal gas in a closed container with a movable piston initially occupies a volume V. The position of the piston is changed, so that the mean kinetic energy of the particles in the gas is doubled and the pressure remains constant.

What is the new volume of the gas?

A. $\frac{V}{4}$

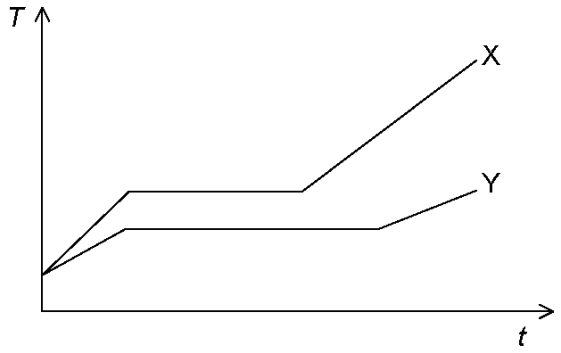
B. $\frac{V}{2}$

C. $2V$

D. $4V$

4 – (PHYSI/12_SL_Summer_2017_Q10) – *Thermal Physics*

The graph shows the variation with time t of the temperature T of two samples, X and Y. X and Y have the same mass and are initially in the solid phase. Thermal energy is being provided to X and Y at the same constant rate.



What is the correct comparison of the specific latent heats L_X and L_Y and specific heat capacities in the liquid phase c_X and c_Y of X and Y?

A.	$L_X > L_Y$	$c_X > c_Y$
B.	$L_X > L_Y$	$c_X < c_Y$
C.	$L_X < L_Y$	$c_X > c_Y$
D.	$L_X < L_Y$	$c_X < c_Y$

5 – (PHYSI/12_SL_Summer_2017_Q11) – *Thermal Physics*

A mass m of ice at a temperature of –5 °C is changed into water at a temperature of 50 °C.

Specific heat capacity of ice $= c_i$
Specific heat capacity of water $= c_w$
Specific latent heat of fusion of ice $= L$

Which expression gives the energy needed for this change to occur?

A. $55\,m\,c_w + m\,L$

B. $55\,m\,c_i + 5\,m\,L$

C. $5\,m\,c_i + 50\,m\,c_w + m\,L$

D. $5\,m\,c_i + 50\,m\,c_w + 5\,m\,L$

6 – (PHYSI/12_SL_Summer_2017_Q12) – *Thermal Physics*

A sealed container contains a mixture of oxygen and nitrogen gas.

The ratio $\frac{\text{mass of an oxygen molecule}}{\text{mass of a nitrogen molecule}}$ is $\frac{8}{7}$.

The ratio $\frac{\text{average kinetic energy of oxygen molecules}}{\text{average kinetic energy of nitrogen molecules}}$ is

A. 1.

B. $\frac{7}{8}$.

C. $\frac{8}{7}$.

D. dependent on the concentration of each gas.

7 – (PHYSI/10_SL_Winter_2017_Q9) – *Thermal Physics*

What does the constant n represent in the equation of state for an ideal gas $pV = nRT$?

A. The number of atoms in the gas

B. The number of moles of the gas

C. The number of molecules of the gas

D. The number of particles in the gas

8 – (PHYSI/10_SL_Winter_2017_Q10) – *Thermal Physics*

A 1.0 kW heater supplies energy to a liquid of mass 0.50 kg. The temperature of the liquid changes by 80 K in a time of 200 s. The specific heat capacity of the liquid is 4.0 kJ $kg^{-1}K^{-1}$. What is the average power lost by the liquid?

A. 0

B. 200 W

C. 800 W

D. 1600 W

9 – (PHYSI/10_SL_Winter_2017_Q11) – *Thermal Physics*

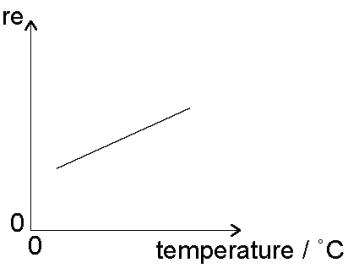
Under what conditions of pressure and temperature does a real gas approximate to an ideal gas?

	Pressure	Temperature
A.	high	high
B.	high	low
C.	low	high
D.	low	low

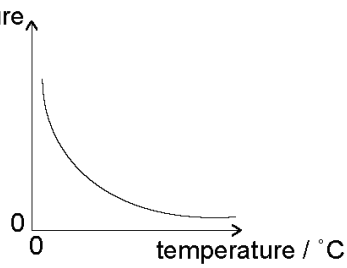
10 – (PHYSI/11_SL_Summer_2018_Q10) – *Thermal Physics*

A fixed mass of an ideal gas is trapped in a cylinder of constant volume and its temperature is varied. Which graph shows the variation of the pressure of the gas with temperature in degrees Celsius?

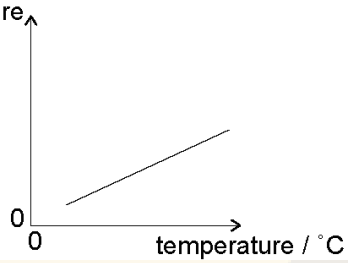
A.



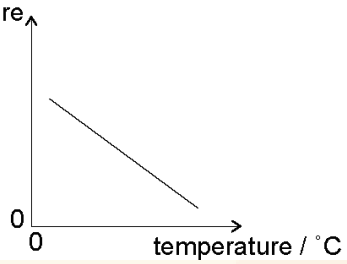
B.



C.



D.



11 – (PHYSI/11_SL_Summer_2018_Q11) – *Thermal Physics*

What are the units of the ratio $\frac{\text{specific heat capacity of copper}}{\text{specific latent heat of vaporization of copper}}$?

A. no units

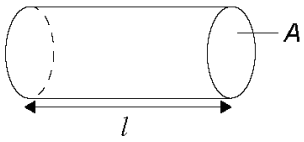
B. k

C. k^{-1}

D. k^{-2}

12 – (PHYSI/11_SL_Summer_2018_Q12) – *Thermal Physics*

A sealed cylinder of length l and cross-sectional area A contains N molecules of an ideal gas at kelvin temperature T.



What is the force acting on the area of the cylinder marked A due to the gas?

A. $\frac{NRT}{l}$

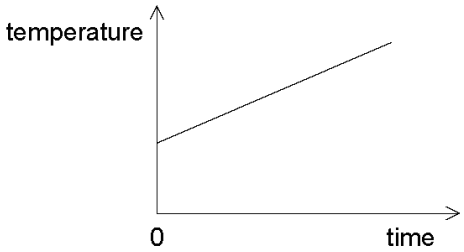
B. $\frac{NRT}{lA}$

C. $\frac{Nk_BT}{lA}$

D. $\frac{Nk_BT}{l}$

13 – (PHYSI/12_SL_Summer_2018_Q11) – *Thermal Physics*

The graph shows how the temperature of a liquid varies with time when energy is supplied to the liquid at a constant rate P. The gradient of the graph is K and the liquid has a specific heat capacity c.



What is the mass of the liquid?

A. $\frac{P}{cK}$

B. $\frac{PK}{c}$

C. $\frac{Pc}{K}$

D. $\frac{cK}{P}$

14 – (PHYSI/12_SL_Summer_2018_Q12) – *Thermal Physics*

A container that contains a fixed mass of an ideal gas is at rest on a truck. The truck now moves away horizontally at a constant velocity. What is the change, if any, in the internal energy of the gas and the change, if any, in the temperature of the gas when the truck has been travelling for some time?

	Change in internal energy	Change in temperature
A.	unchanged	unchanged
B.	unchanged	increased
C.	increased	unchanged
D.	increased	increased

15 – (PHYSI/12_SL_Summer_2018_Q13) – *Thermal Physics*

A sealed container contains water at 5 °C and ice at 0 °C. This system is thermally isolated from its surroundings. What happens to the total internal energy of the system?

A. It remains the same.

B. It decreases.

C. It increases until the ice melts and then remains the same.

D. It increases.

16 – (PHYSI/10_SL_Winter_2018_Q10) – *Thermal Physics*

A 700 W electric heater is used to heat 1 kg of water without energy losses. The specific heat capacity of water is 4.2 kJ kg^{-1} K^{-1}. What is the time taken to heat the water from 25 °C to 95 °C?

A. 7 s

B. 30 s

C. 7 minutes

D. 420 minutes

17 – (PHYSI/10_SL_Winter_2018_Q11) – *Thermal Physics*

A container is filled with a mixture of helium and oxygen at the same temperature. The molar mass of helium is 4 g mol^{-1} and that of oxygen is 32 g mol^{-1}.

What is the ratio $\frac{\text{average speed of helium molecules}}{\text{average speed of oxygen molecules}}$?

A. $\frac{1}{8}$

B. $\frac{1}{\sqrt{8}}$

C. $\sqrt{8}$

D. 8

18 – (PHYSI/10_SL_Winter_2018_Q12) – *Thermal Physics*

Container X contains 1.0 mol of an ideal gas. Container Y contains 2.0 mol of the ideal gas. Y has four times the volume of X. The pressure in X is twice that in Y.

What is $\frac{\text{temperature of gas in X}}{\text{temperature of gas in Y}}$?

A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. 1

D. 2

19 – (PHYSI/11_SL_Summer_2019_Q10) – *Thermal Physics*

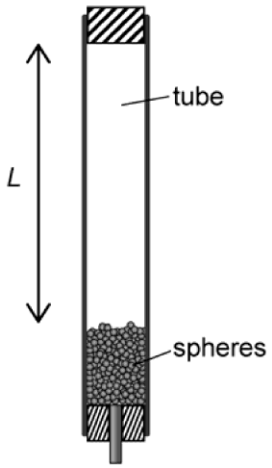
Energy is transferred to water in a flask at a rate *P*. The water reaches boiling point and then *P* is increased. What are the changes to the temperature of the water and to the rate of vaporization of the water after the change?

	Temperature	Rate of vaporization
A.	increases	unchanged
B.	increases	increases
C.	unchanged	unchanged
D.	unchanged	increases

20 – (PHYSI/11_SL_Summer_2019_Q11) – *Thermal Physics*

An insulated tube is filled with a large number n of lead spheres, each of mass m. The tube is inverted s times so that the spheres completely fall through an average distance L each time. The temperature of the spheres is measured before and after the inversions and the resultant change in temperature is ΔT.

What is the specific heat capacity of lead?



A. $\frac{sgL}{nm\Delta T}$

B. $\frac{sgL}{\Delta T}$

C. $\frac{sgL}{n\Delta T}$

D. $\frac{gL}{m\Delta T}$

21 – (PHYSI/11_SL_Summer_2019_Q12) – *Thermal Physics*

Boiling water is heated in a 2 kW electric kettle. The initial mass of water is 0.4 kg. Assume the specific latent heat of vaporization of water is 2 MJ kg^{-1}.

What is the time taken for all the water to vaporize?

A. 250 s

B. 400 s

C. 2500 s

D. 4000 s

22 – (PHYSI/11_SL_Summer_2019_Q13) – *Thermal Physics*

A gas storage tank of fixed volume V contains N molecules of an ideal gas at temperature T. The pressure at kelvin temperature T is 20 MPa. $\frac{N}{4}$ molecules are removed and the temperature changed to $2T$. What is the new pressure of the gas?

A. 10 MPa

B. 15 MPa

C. 30 MPa

D. 40 MPa

23 – (PHYSI/11_SL_Summer_2019_Q29) – *Thermal Physics*

A beaker containing 1 kg of water at room temperature is heated on a 400 W hot plate. The specific heat capacity of water is 4200 $Jkg^{-1}K^{-1}$.

The temperature of the water increases until it reaches a constant value. It is then removed from the hot plate.
What will be the initial rate of change of temperature?

A. 10 Ks^{-1}

B. 1 Ks^{-1}

C. 0.1 Ks^{-1}

D. 0.01 Ks^{-1}

24 – (PHYSI/12_SL_Summer_2019_Q10) – *Thermal Physics*

A substance changes from the solid phase to the gas phase without becoming a liquid and without a change in temperature.

What is true about the internal energy of the substance and the total intermolecular potential energy of the substance when this phase change occurs?

	Internal energy of the substance	Total intermolecular potential energy of the substance
A.	increases	no change
B.	no change	no change
C.	increases	increases
D.	no change	increases

25 – (PHYSI/12_SL_Summer_2019_Q11) – *Thermal Physics*

The temperature of a fixed mass of an ideal gas changes from 200 °C to 400 °C.

What is $\frac{\text{mean kinetic energy of gas at 200 °C}}{\text{mean kinetic energy of gas at 400 °C}}$?

A. 0.50

B. 0.70

C. 1.4

D. 2.0

26 – (PHYSI/12_SL_Summer_2019_Q12) – *Thermal Physics*

A container holds 20 g of argon-40 ($^{40}_{18}$Ar) and 40 g of neon-20 ($^{20}_{10}$Ne).

What is $\frac{\text{number of atoms of argon-40}}{\text{number of atoms of neon-20}}$ in the container?

A. 0.25

B. 0.5

C. 2

D. 4

27 – (PHYSI/10_SL_Winter_2019_Q9) – *Thermal Physics*

A mass m of water is at a temperature of 290 K. The specific heat capacity of water is c. Ice, at its melting point, is added to the water to reduce the water temperature to the freezing point. The specific latent heat of fusion for ice is L. What is the minimum mass of ice that is required?

A. $\frac{17mc}{L}$

B. $\frac{290mc}{L}$

C. $\frac{17mL}{c}$

D. $\frac{290mL}{c}$

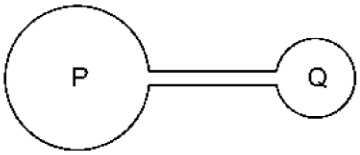
28 – (PHYSI/10_SL_Winter_2019_Q10) – *Thermal Physics*

An ideal gas is in a closed container. Which changes to its volume and temperature when taken together must cause a decrease in the gas pressure?

	Volume	Temperature
A.	decrease	increase
B.	decrease	decrease
C.	increase	increase
D.	increase	decrease

29 – (PHYSI/10_SL_Winter_2019_Q11) – *Thermal Physics*

Two flasks P and Q contain an ideal gas and are connected with a tube of negligible volume compared to that of the flasks. The volume of P is twice the volume of Q.



P is held at a temperature of 200 K and Q is held at a temperature of 400 K.

What is $\frac{\text{mass of gas in P}}{\text{mass of gas in Q}}$?

A. $\frac{1}{8}$

B. $\frac{1}{4}$

C. 4

D. 8

30 – (PHYSI/10_SL_Winter_2020_Q11) – *Thermal Physics*

An ideal gas of constant mass is heated in a container of constant volume. What is the reason for the increase in pressure of the gas?

A. The average number of molecules per unit volume increases.

B. The average force per impact at the container wall increases.

C. Molecules collide with each other more frequently.

D. Molecules occupy a greater fractional volume of the container.

31 – (PHYSI/10_SL_Winter_2020_Q12) – *Thermal Physics*

A substance in the gas state has a density about 1000 times less than when it is in the liquid state. The diameter of a molecule is *d*. What is the best estimate of the average distance between molecules in the gas state?

A. *d*

B. 10*d*

C. 100*d*

D. 1000*d*

32 – (PHYSI/10_SL_Winter_2020_Q13) – *Thermal Physics*

A bicycle of mass *M* comes to rest from speed *v* using the back brake. The brake has a specific heat capacity of *c* and a mass *m*. Half of the kinetic energy is absorbed by the brake. What is the change in temperature of the brake?

A. $\frac{Mv^2}{4mc}$

B. $\frac{Mv^2}{2mc}$

C. $\frac{mv^2}{4Mc}$

D. $\frac{mv^2}{2Mc}$

33 – (PHYSI/11_SL_Summer_2021_Q10) – *Thermal Physics*

Which aspect of thermal physics is best explained by the molecular kinetic model?

A. The equation of state of ideal gases

B. The difference between Celsius and Kelvin temperature

C. The value of the Avogadro constant

D. The existence of gaseous isotopes

34 – (PHYSI/11_SL_Summer_2021_Q11) – *Thermal Physics*

When 40 kJ of energy is transferred to a quantity of a liquid substance, its temperature increases by 20 K. When 600 kJ of energy is transferred to the same quantity of the liquid at its boiling temperature, it vaporizes completely at constant temperature. What is

$$\frac{\text{specific latent heat of vaporization}}{\text{specific heat capacity of the liquid}}$$

for this substance?

A. 15 K [1]

B. 15 K

C. 300 K

D. 300 K

35 – (PHYSI/11_SL_Summer_2021_Q12) – *Thermal Physics*

A quantity of 2.00 mol of an ideal gas is maintained at a temperature of 127 °C in a container of volume 0.083 m^3. What is the pressure of the gas?

A. 8 kPa

B. 25 kPa

C. 40 kPa

D. 80 kPa

36 – (PHYSI/12_SL_Summer_2021_Q10) – *Thermal Physics*

A sample of oxygen gas with a volume of 3.0 m^3 is at 100 °C. The gas is heated so that it expands at a constant pressure to a final volume of 6.0 m^3. What is the final temperature of the gas?

A. 750 °C

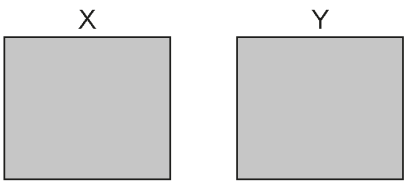
B. 470 °C

C. 370 °C

D. 200 °C

37 – (PHYSI/12_SL_Summer_2021_Q11) – *Thermal Physics*

Two identical containers X and Y each contain an ideal gas. X has N molecules of gas at an absolute temperature of T and Y has $3N$ molecules of gas at an absolute temperature of $\frac{T}{2}$. What is the ratio of the pressures $\frac{P_Y}{P_X}$?



A. $\frac{1}{6}$

B. $\frac{2}{3}$

C. $\frac{3}{2}$

D. 6

38 – (PHYSI/12_SL_Summer_2021_Q12) – *Thermal Physics*

A piece of metal at a temperature of 100 °C is dropped into an equal mass of water at a temperature of 15 °C in a container of negligible mass. The specific heat capacity of water is four times that of the metal. What is the final temperature of the mixture?

A. 83 °C

B. 57 °C

C. 45 °C

D. 32 °C

39 – (PHYSI/10_SL_Winter_2021_Q10) – *Thermal Physics*

A liquid is vaporized to a gas at a constant temperature.

Three quantities of the substance are the

I. total intermolecular potential energy
II. root mean square speed of the molecules
III. average distance between the molecules.

Which quantities are **greater** for the substance in the gas phase compared to the liquid phase?

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

40 – (PHYSI/10_SL_Winter_2021_Q11) – *Thermal Physics*

A mass m of a liquid of specific heat capacity c flows every second through a heater of power P. What is the difference in temperature between the liquid entering and leaving the heater?

A. $\frac{mc}{P}$
B. $273 + \frac{mc}{P}$
C. $\frac{P}{mc}$
D. $273 + \frac{P}{mc}$

41 – (PHYSI/10_SL_Winter_2021_Q12) – *Thermal Physics*

A fixed mass of an ideal gas has a volume of V, a pressure of p and a temperature of 30 °C. The gas is compressed to the volume of $\frac{V}{6}$ and its pressure increases to $12p$. What is the new temperature of the gas?

A. 15 °C
B. 60 °C
C. 333 °C
D. 606 °C

42 – (PHYSI/11_SL_Summer_2022_Q10) – *Thermal Physics*

A driver uses the brakes on a car to descend a hill at constant speed. What is correct about the internal energy of the brake discs?

A. The internal energy increases.

B. The internal energy decreases.

C. There is no change in the internal energy.

D. The internal energy is zero.

43 – (PHYSI/11_SL_Summer_2022_Q11) – *Thermal Physics*

Two blocks, X and Y, are placed in contact with each other. Data for the blocks are provided.

	Block X	Block Y
Initial temperature / °C	20	80
Final temperature / °C	60	60
Specific heat capacity	$2c$	c

X has a mass m. What is the mass of Y?

A. $\frac{m}{4}$

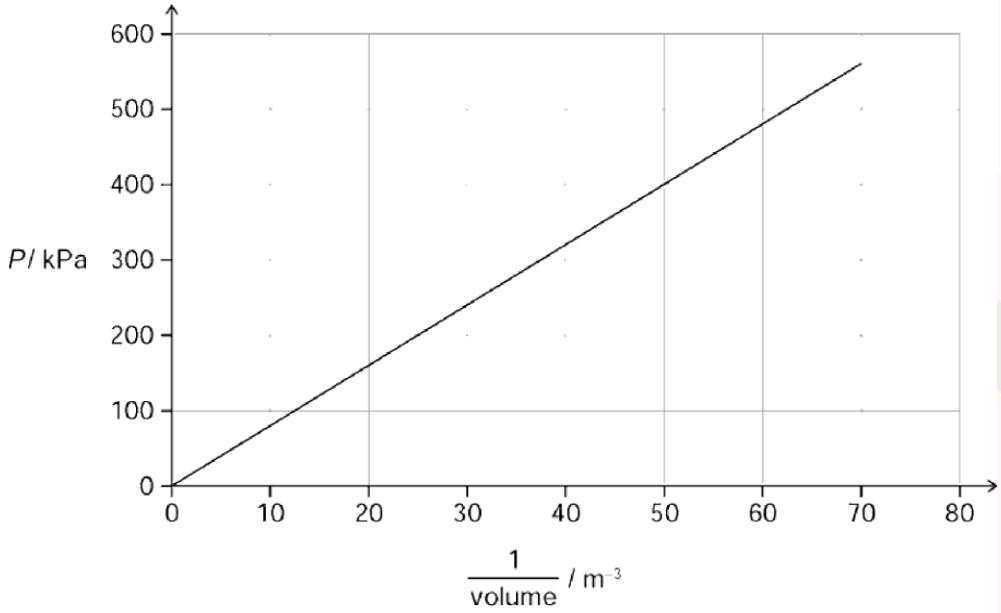
B. m

C. $4m$

D. $6m$

44 – (PHYSI/11_SL_Summer_2022_Q12) – *Thermal Physics*

An ideal gas is maintained at a temperature of 100 K. The variation of the pressure P and $\frac{1}{\text{volume}}$ of the gas is shown.



What is the quantity of the gas?

A. $\frac{2\times10^{5}}{R}$ mol

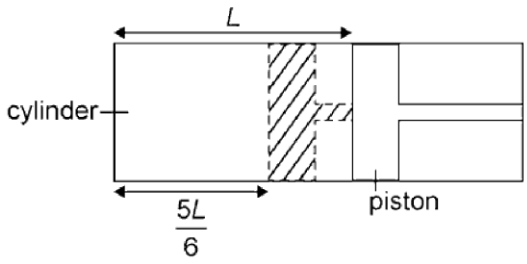
B. $\frac{200}{R}$ mol

C. $\frac{80}{R}$ mol

D. $\frac{4}{5R}$ mol

45 – (PHYSI/12_SL_Summer_2022_Q10) – *Thermal Physics*

A quantity of an ideal gas is at a temperature T in a cylinder with a movable piston that traps a length L of the gas. The piston is moved so that the length of the trapped gas is reduced to $\frac{5L}{6}$ and the pressure of the gas doubles.



What is the temperature of the gas at the end of the change?

A. $\frac{5}{12}T$

B. $\frac{3}{5}T$

C. $\frac{5}{3}T$

D. $\frac{12}{5}T$

46 – (PHYSI/12_SL_Summer_2022_Q11) – *Thermal Physics*

What is true for an ideal gas?

A. $nRT - Nk_BT$

B. $nRT - k_BT$

C. $RT = Nk_BT$

D. $RT = k_BT$

47 – (PHYSI/12_SL_Summer_2022_Q12) – *Thermal Physics*

Which assumption is part of the molecular kinetic model of ideal gases?

A. The work done on a system equals the change in kinetic energy of the system.

B. The volume of a gas results from adding the volume of the individual molecules.

C. A gas is made up of tiny identical particles in constant random motion.

D. All particles in a gas have kinetic and potential energy.

48 – (PHYSI/12_SL_Summer_2022_Q13) – *Thermal Physics*

System X is at a temperature of 40 °C. Thermal energy is provided to system X until it reaches a temperature of 50 °C. **System Y** is at a temperature of 283 K. Thermal energy is provided to system Y until it reaches a temperature of 293 K.

What is the difference in the thermal energy provided to both systems?

A. Zero

B. Larger for X

C. Larger for Y

D. Cannot be determined with the data given

49 – (PHYSI/10_SL_Winter_2022_Q8) – *Thermal Physics*

A block of glass of mass 5 kg and temperature 30 °C is brought into contact with a block of asphalt of mass 20 kg and temperature 75 °C. The specific heat capacity of asphalt is twice that of glass. No energy is transferred to the surroundings. What is the final temperature of both blocks?

A. 35 °C

B. 45 °C

C. 60 °C

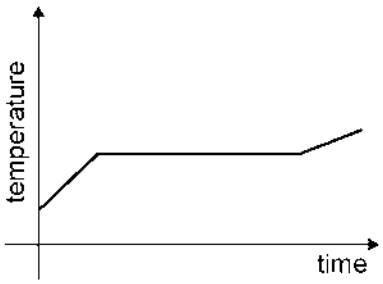
D. 70 °C

50 – (PHYSI/10_SL_Winter_2022_Q9) – *Thermal Physics*

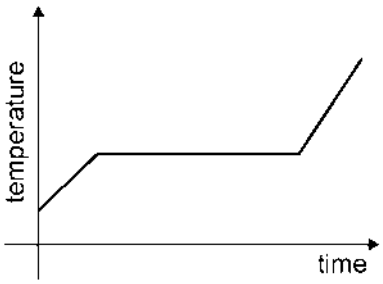
A solid mass gains energy at a constant rate until it reaches its liquid phase. The specific heat capacity in the solid phase is greater than in the liquid phase.

Which graph shows how the temperature of the mass varies with time?

A.

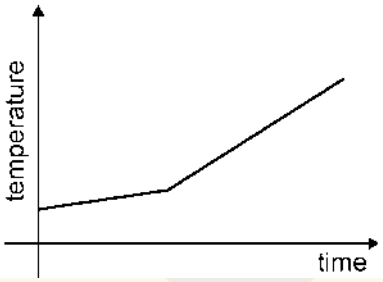


B.



C.

D.



51 – (PHYSI/10_SL_Winter_2022_Q10) – *Thermal Physics*

Three statements about Boltzmann's constant k_B are:

I. k_B has a unit of $J K^{-1}$

II. $k_B = \frac{\text{gas constant}}{\text{Avogadro's constant}}$

III. $k_B = \frac{\text{the average kinetic energy of particles}}{\text{temperature of the gas}}$

Which statements are correct?

A. I and II only

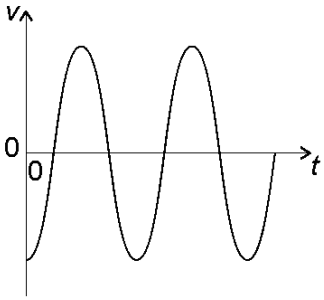
B. I and III only

C. II and III only

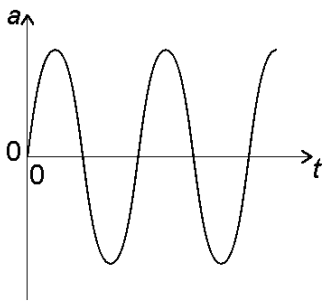
D. I, II and III

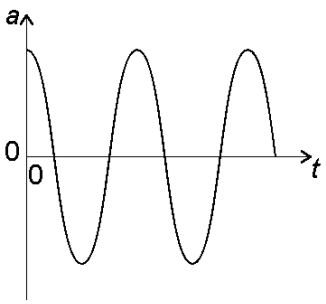
1 – (PHYSI/11_SL_Summer_2017_Q13) – *Oscillations & Waves*

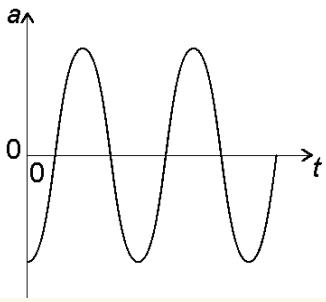
A particle undergoes simple harmonic motion (SHM). The graph shows the variation of velocity *v* of the particle with time *t*.

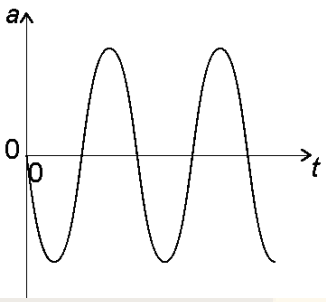


What is the variation with time of the acceleration *a* of the particle?

A.


B.


C.


D.


2 – (PHYSI/11_SL_Summer_2017_Q14) – *Oscillations & Waves*

What statement about X-rays and ultraviolet radiation is correct?

A. X-rays travel faster in a vacuum than ultraviolet waves.

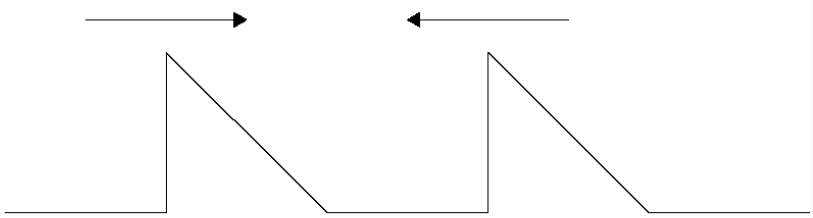
B. X-rays have a higher frequency than ultraviolet waves.

C. X-rays cannot be diffracted unlike ultraviolet waves.

D. Microwaves lie between X-rays and ultraviolet in the electromagnetic spectrum.

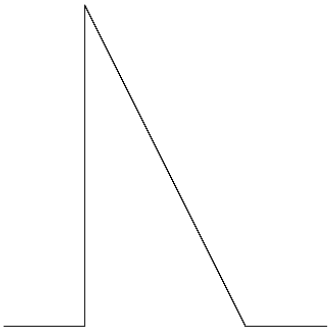
3 – (PHYSI/11_SL_Summer_2017_Q15) – *Oscillations & Waves*

Two pulses are travelling towards each other.

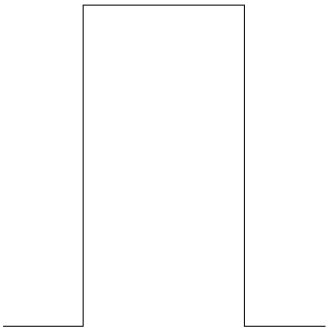


What is a possible pulse shape when the pulses overlap?

A.

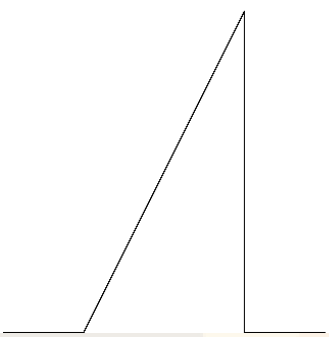


B.



C.

D.



4 – (PHYSI/11_SL_Summer_2017_Q16) – *Oscillations & Waves*

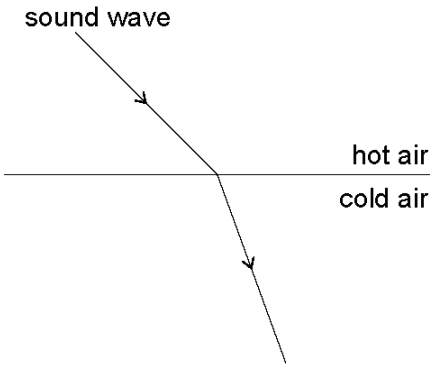
Unpolarized light of intensity I_0 is incident on the first of two polarizing sheets. Initially the planes of polarization of the sheets are perpendicular.

Which sheet must be rotated and by what angle so that light of intensity $\frac{I_0}{4}$ can emerge from the second sheet?

	Rotated sheet	Angle of rotation
A.	1 only	$\cos^{-1}\frac{\sqrt{2}}{2}$
B.	2 only	$\cos^{-1}\frac{1}{2}$
C.	1 or 2	$\cos^{-1}\frac{\sqrt{2}}{2}$
D.	1 or 2	$\cos^{-1}\frac{1}{2}$

5 – (PHYSI/11_SL_Summer_2017_Q17) – *Oscillations & Waves*

When a sound wave travels from a region of hot air to a region of cold air, it refracts as shown.



What changes occur in the frequency and wavelength of the sound as it passes from the hot air to the cold air?

	Frequency	Wavelength
A.	unchanged	increases
B.	unchanged	decreases
C.	increases	increases
D.	decreases	decreases

6 – (PHYSI/12_SL_Summer_2017_Q13) – *Oscillations & Waves*

In simple harmonic oscillations which two quantities always have opposite directions?

A. Kinetic energy and potential energy

B. Velocity and acceleration

C. Velocity and displacement

D. Acceleration and displacement

7 – (PHYSI/12_SL_Summer_2017_Q14) – *Oscillations & Waves*

A girl in a stationary boat observes that 10 wave crests pass the boat every minute. What is the period of the water waves?

A. $\frac{1}{10}$ min

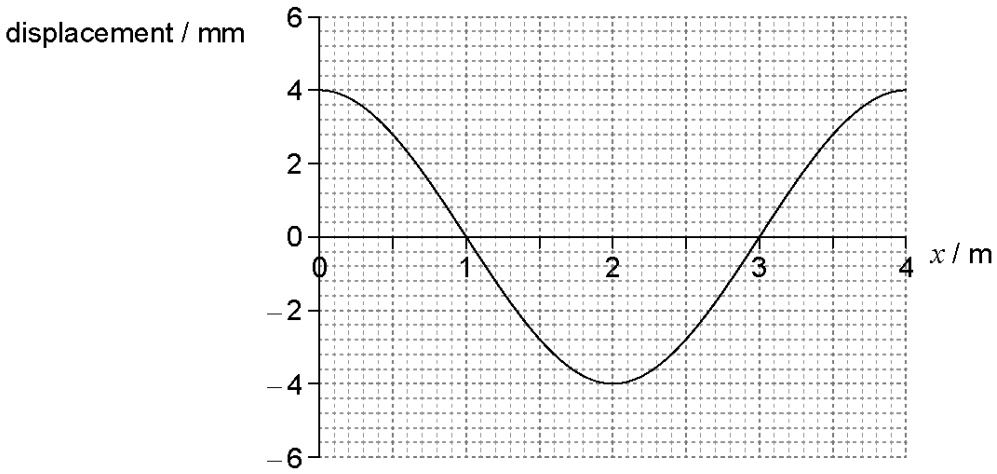
B. $\frac{1}{10}$ min^{-1}

C. 10 min

D. 10 min^{-1}

8 – (PHYSI/12_SL_Summer_2017_Q15) – *Oscillations & Waves*

The graph shows the variation with distance x of the displacement of the particles of a medium in which a longitudinal wave is travelling from left to right. Displacements to the right of equilibrium positions are positive.



Which point is at the centre of a compression?

A. $x = 0$

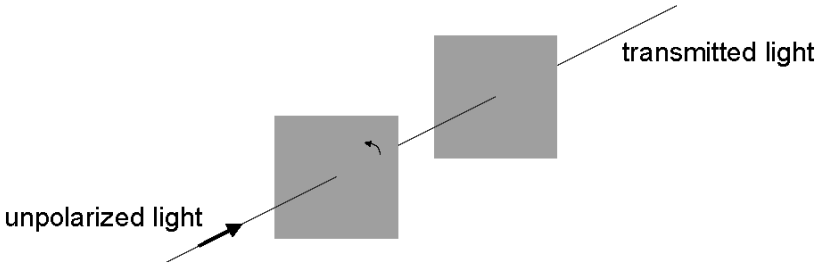
B. $x = 1\ \text{m}$

C. $x = 2\ \text{m}$

D. $x = 3\ \text{m}$

9 – (PHYSI/12_SL_Summer_2017_Q16) – *Oscillations & Waves*

A beam of unpolarized light is incident on the first of two parallel polarizers. The transmission axes of the two polarizers are initially parallel.



The first polarizer is now rotated about the direction of the incident beam by an angle smaller than 90°. Which gives the changes, if any, in the intensity and polarization of the transmitted light?

	Intensity	Polarization
A.	different	no change
B.	different	different
C.	no change	no change
D.	no change	different

10 – (PHYSI/12_SL_Summer_2017_Q17) – *Oscillations & Waves*

The frequency of the first harmonic standing wave in a pipe that is open at both ends is 200 Hz. What is the frequency of the first harmonic in a pipe of the same length that is open at one end and closed at the other?

A. 50 Hz

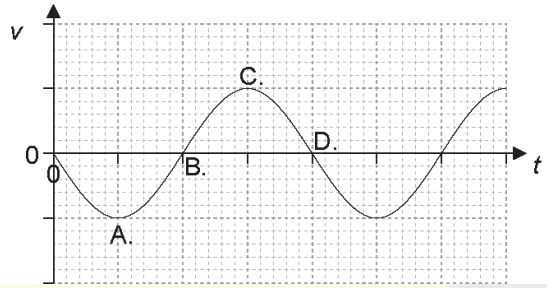
B. 75 Hz

C. 100 Hz

D. 400 Hz

11 – (PHYSI/10_SL_Winter_2017_Q12) – *Oscillations & Waves*

The graph shows the variation with time *t* of the velocity *v* of an object undergoing simple harmonic motion (SHM). At which velocity does the displacement from the mean position take a maximum positive value?



12 – (PHYSI/10_SL_Winter_2017_Q13) – *Oscillations & Waves*

What is the phase difference, in rad, between the centre of a compression and the centre of a rarefaction for a longitudinal travelling wave?

A. 0

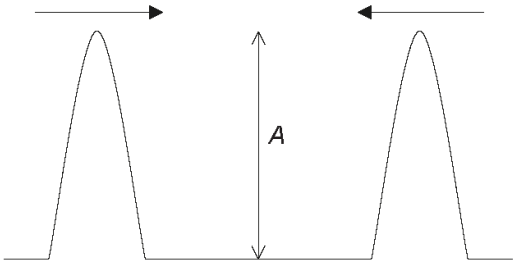
B. $\frac{\pi}{2}$

C. π

D. 2π

13 – (PHYSI/10_SL_Winter_2017_Q14) – *Oscillations & Waves*

Two wave pulses, each of amplitude *A*, approach each other. They then superpose before continuing in their original directions. What is the total amplitude during superposition and the amplitudes of the individual pulses after superposition?



	Total amplitude during superposition	Individual amplitudes after superposition
A.	*A*	less than *A*
B.	*A*	*A*
C.	2*A*	less than *A*
D.	2*A*	*A*

14 – (PHYSI/10_SL_Winter_2017_Q15) – *Oscillations & Waves*

The refractive index for light travelling from medium X to medium Y is $\frac{4}{3}$. The refractive index for light travelling from medium Y to medium Z is $\frac{3}{5}$. What is the refractive index for light travelling from medium X to medium Z?

A. $\frac{4}{5}$

B. $\frac{15}{12}$

C. $\frac{5}{4}$

D. $\frac{29}{15}$

15 – (PHYSI/10_SL_Winter_2017_Q16) – *Oscillations & Waves*

A pipe of fixed length is closed at one end. What is $\frac{\text{third harmonic frequency of pipe}}{\text{first harmonic frequency of pipe}}$?

A. $\frac{1}{5}$

B. $\frac{1}{3}$

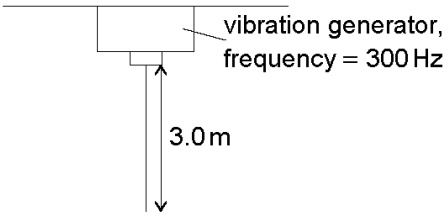
C. 3

D. 5

16 – (PHYSI/11_SL_Summer_2018_Q13) – *Oscillations & Waves*

A first-harmonic standing wave is formed on a vertical string of length 3.0 m using a vibration generator. The boundary conditions for this string are that it is fixed at one boundary and free at the other boundary.

diagram not to scale



The generator vibrates at a frequency of 300 Hz.

What is the speed of the wave on the string?

A. $0.90\,\text{km s}^{-1}$

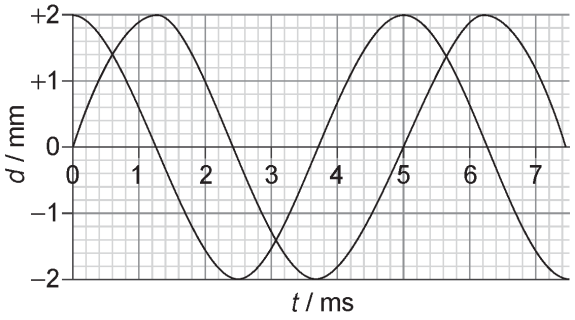
B. $1.2\,\text{km s}^{-1}$

C. $1.8\,\text{km s}^{-1}$

D. $3.6\,\text{km s}^{-1}$

17 – (PHYSI/11_SL_Summer_2018_Q14) – *Oscillations & Waves*

Two travelling waves are moving through a medium. The diagram shows, for a point in the medium, the variation with time t of the displacement d of each of the waves.

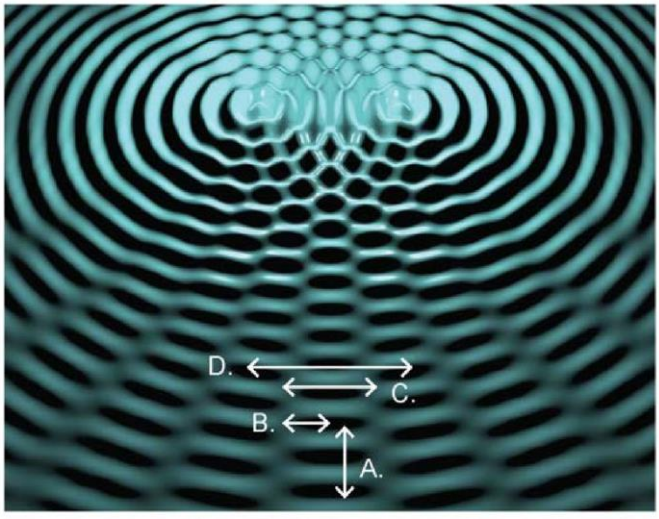


For the instant when $t = 2.0\,\text{ms}$, what is the phase difference between the waves and what is the resultant displacement of the waves?

	Phase difference	Resultant displacement / mm
A.	45°	–0.6
B.	90°	2.6
C.	45°	2.6
D.	90°	–0.6

18 – (PHYSI/11_SL_Summer_2018_Q15) – *Oscillations & Waves*

The diagram shows an interference pattern produced by two sources that oscillate on the surface of a liquid.



[Source: Science Photo Library www.sciencephoto.com]

Which of the distances shown in the diagram corresponds to **one** fringe width of the interference pattern?

19 – (PHYSI/11_SL_Summer_2018_Q16) – *Oscillations & Waves*

A system that is subject to a restoring force oscillates about an equilibrium position.

For the motion to be simple harmonic, the restoring force must be proportional to

A. the amplitude of the oscillation.

B. the displacement from the equilibrium position.

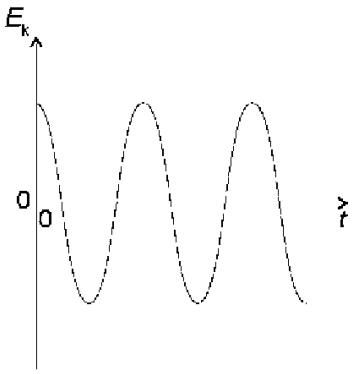
C. the potential energy of the system.

D. the period of the oscillation.

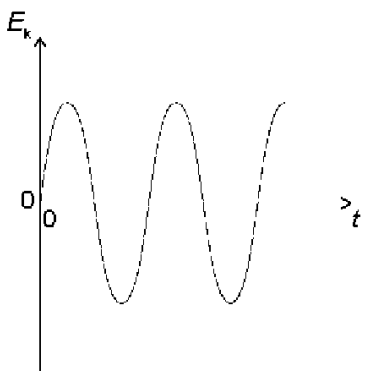
20 – (PHYSI/11_SL_Summer_2018_Q17) – *Oscillations & Waves*

A particle is displaced from rest and released at time $t = 0$. It performs simple harmonic motion (SHM). Which graph shows the variation with time of the kinetic energy E_k of the particle?

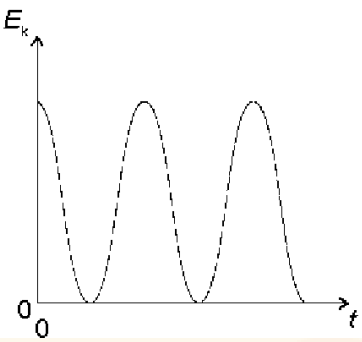
A.



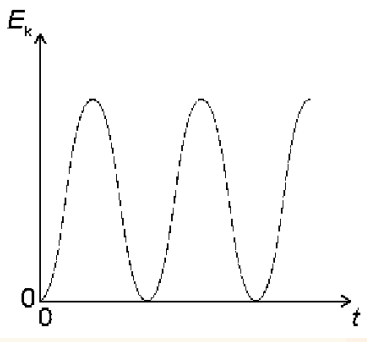
B.



C.



D.



21 – (PHYSI/12_SL_Summer_2018_Q14) – *Oscillations & Waves*

Two sound waves from a point source on the ground travel through the ground to a detector. The speed of one wave is 7.5 km s^{-1}, the speed of the other wave is 5.0 km s^{-1}. The waves arrive at the detector 15 s apart. What is the distance from the point source to the detector?

A. 38 km

B. 45 km

C. 113 km

D. 225 km

22 – (PHYSI/12_SL_Summer_2018_Q15) – *Oscillations & Waves*

What is true about the acceleration of a particle that is oscillating with simple harmonic motion (SHM)?

A. It is in the opposite direction to its velocity

B. It is decreasing when the potential energy is increasing

C. It is proportional to the frequency of the oscillation

D. It is at a minimum when the velocity is at a maximum

23 – (PHYSI/12_SL_Summer_2018_Q16) – *Oscillations & Waves*

What are the changes in the speed and in the wavelength of monochromatic light when the light passes from water to air?

	Change in speed	Change in wavelength
A.	increases	increases
B.	increases	decreases
C.	decreases	increases
D.	decreases	decreases

24 – (PHYSI/12_SL_Summer_2018_Q17) – *Oscillations & Waves*

A sound wave has a wavelength of 0.20 m. What is the phase difference between two points along the wave which are 0.85 m apart?

A. zero

B. 45°

C. 90°

D. 180°

25 – (PHYSI/12_SL_Summer_2018_Q18) – *Oscillations & Waves*

A pair of slits in a double slit experiment are illuminated with monochromatic light of wavelength 480 nm. The slits are separated by 1.0 mm. What is the separation of the fringes when observed at a distance of 2.0 m from the slits?

A. 2.4×10^{-4} mm

B. 9.6×10^{-4} mm

C. 2.4×10^{-1} mm

D. 9.6×10^{-1} mm

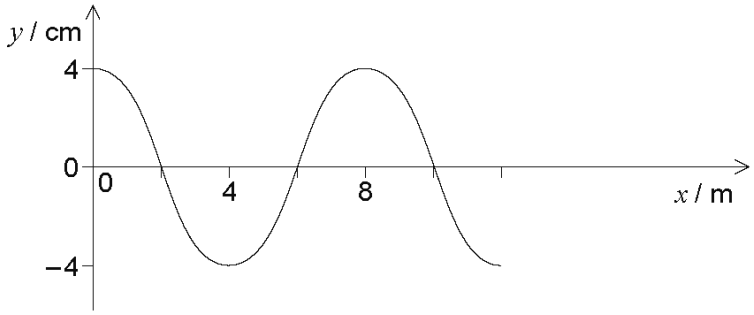
26 – (PHYSI/10_SL_Winter_2018_Q14) – *Oscillations & Waves*

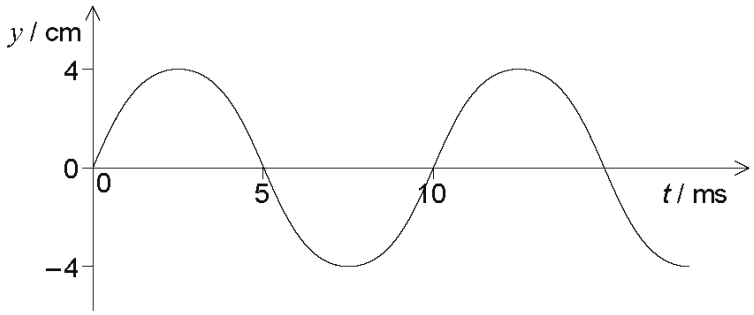
A longitudinal wave moves through a medium. Relative to the direction of energy transfer through the medium, what are the displacement of the medium and the direction of propagation of the wave?

	Displacement of medium	Direction of propagation of wave
A.	parallel	perpendicular
B.	parallel	parallel
C.	perpendicular	parallel
D.	perpendicular	perpendicular

27 – (PHYSI/10_SL_Winter_2018_Q15) – *Oscillations & Waves*

The graphs show the variation of the displacement y of a medium with distance x and with time t for a travelling wave.





What is the speed of the wave?

A. $0.6\ \text{m s}^{-1}$

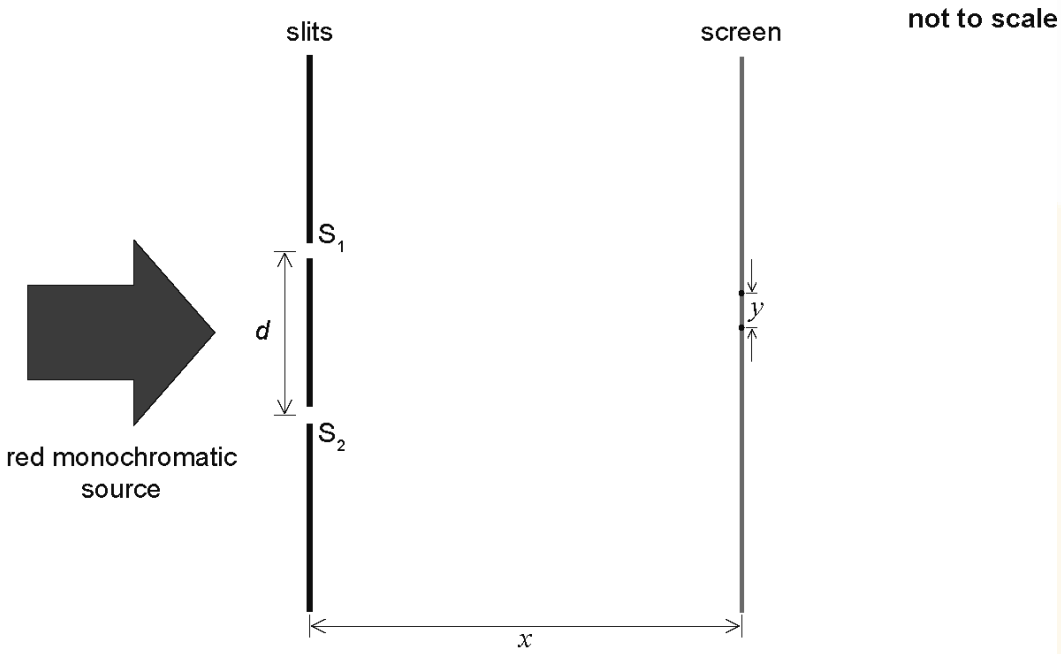
B. $0.8\ \text{m s}^{-1}$

C. $600\ \text{m s}^{-1}$

D. $800\ \text{m s}^{-1}$

28 – (PHYSI/10_SL_Winter_2018_Q16) – *Oscillations & Waves*

In a double-slit experiment, a source of monochromatic red light is incident on slits S_1 and S_2 separated by a distance *d*. A screen is located at distance x from the slits. A pattern with fringe spacing y is observed on the screen.



Three changes are possible for this arrangement

I. increasing x

II. increasing *d*

III. using green monochromatic light instead of red.

Which changes will cause a decrease in fringe spacing y?

A. I and II only

B. I and III only

C. II and III only

D. I, II, and III

29 – (PHYSI/10_SL_Winter_2018_Q17) – *Oscillations & Waves, Wave Phenomena (ahl)*

Two strings of lengths L_1 and L_2 are fixed at both ends. The wavespeed is the same for both strings. They both vibrate at the same frequency. L_1 vibrates at its first harmonic. L_2 vibrates at its third harmonic.

What is $\frac{L_2}{L_1}$?

A. $\frac{1}{3}$

B. 1

C. 2

D. 3

30 – (PHYSI/10_SL_Winter_2018_Q18) – *Oscillations & Waves*

Two copper wires X and Y are connected in series. The diameter of Y is double that of X. The drift speed in X is v. What is the drift speed in Y?

A. $\frac{v}{4}$

B. $\frac{v}{2}$

C. $2v$

D. $4v$

31 – (PHYSI/11_SL_Summer_2019_Q14) – *Oscillations & Waves*

A particle performs simple harmonic motion (shm). What is the phase difference between the displacement and the acceleration of the particle?

A. 0

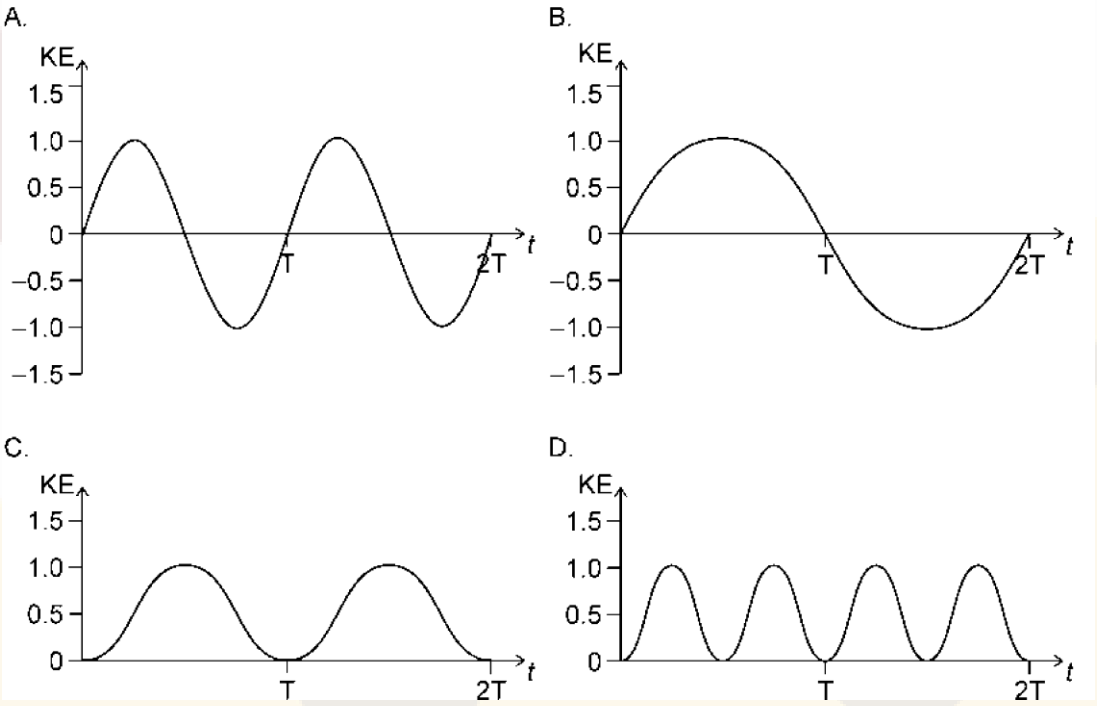
B. $\frac{\pi}{2}$

C. π

D. $\frac{3\pi}{2}$

32 – (PHYSI/11_SL_Summer_2019_Q15) – *Oscillations & Waves*

Which graph shows the variation with time *t* of the kinetic energy (KE) of an object undergoing simple harmonic motion (shm) of period T?



33 – (PHYSI/11_SL_Summer_2019_Q16) – *Oscillations & Waves*

What are the changes in speed, frequency and wavelength of light as it travels from a material of low refractive index to a material of high refractive index?

	Speed	Frequency	Wavelength
A.	decreases	decreases	unchanged
B.	decreases	unchanged	unchanged
C.	unchanged	increases	decreases
D.	decreases	unchanged	decreases

34 – (PHYSI/11_SL_Summer_2019_Q17) – *Oscillations & Waves*

Which of these waves cannot be polarized?

A. microwaves

B. ultrasound

C. ultraviolet

D. X rays

35 – (PHYSI/11_SL_Summer_2019_Q18) – *Oscillations & Waves*

A string fixed at both ends vibrates in the first harmonic with frequency 400 Hz. The speed of sound in the string is 480 m s^{-1}. What is the length of the string?

A. 0.42 m

B. 0.60 m

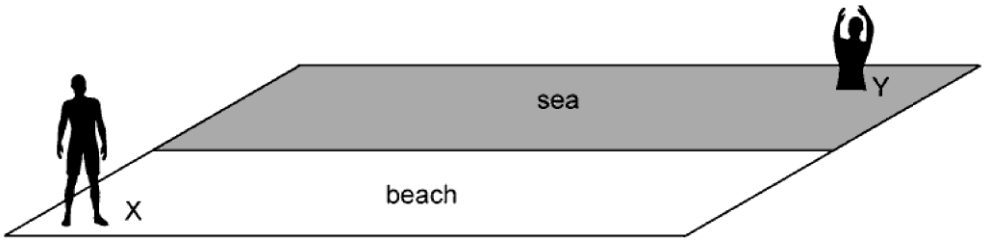
C. 0.84 m

D. 1.2 m

36 – (PHYSI/11_SL_Summer_2019_Q19) – *Oscillations & Waves*

In science, models are extensively used to study real life situations.

A person X on the beach wants to reach a person Y in the sea in the shortest possible time. The speed of person X on land is different from the speed of person X in the water. Which physical phenomenon will best model the path with the least time?



A. Conservation of momentum

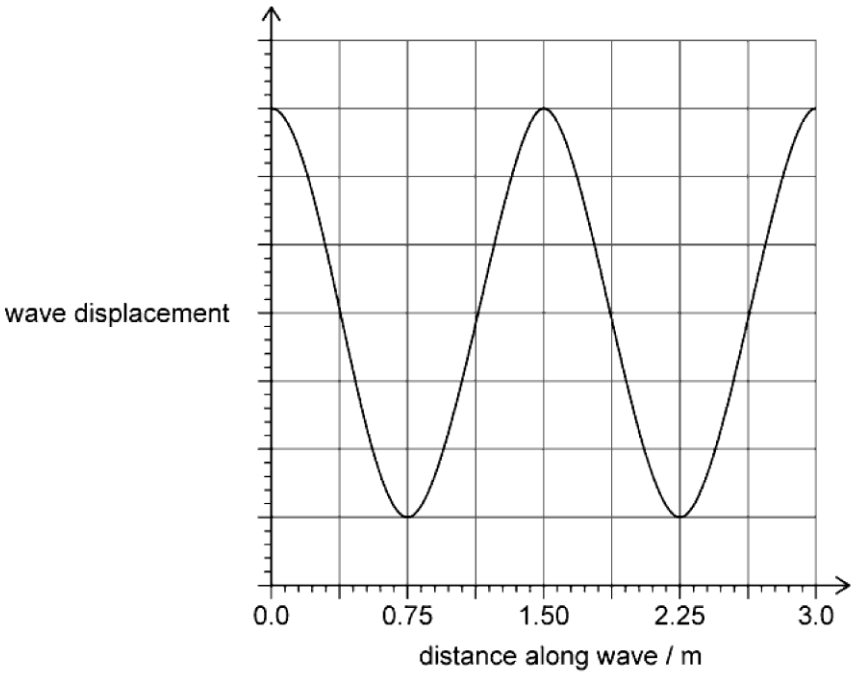
B. Diffraction

C. Flow of charge in a conductor

D. Refraction

37 – (PHYSI/12_SL_Summer_2019_Q13) – *Oscillations & Waves*

The graph shows the variation of the displacement of a wave with distance along the wave. The wave speed is $0.50\,m\,s^{-1}$.



What is the period of the wave?

A. 0.33 s

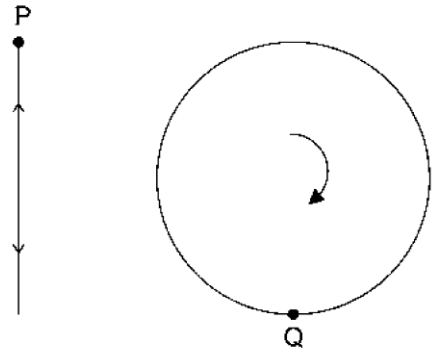
B. 1.5 s

C. 3.0 s

D. 6.0 s

38 – (PHYSI/12_SL_Summer_2019_Q14) – *Oscillations & Waves*

Object P moves vertically with simple harmonic motion (shm). Object Q moves in a vertical circle with a uniform speed. P and Q have the same time period T. When P is at the top of its motion, Q is at the bottom of its motion.



What is the interval between successive times when the acceleration of P is equal and opposite to the acceleration of Q?

A. $\frac{T}{4}$

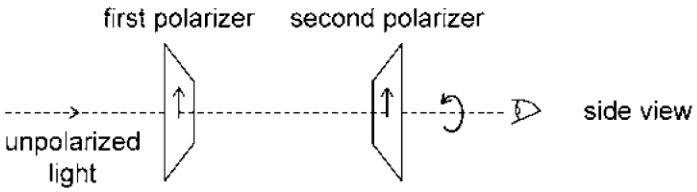
B. $\frac{T}{2}$

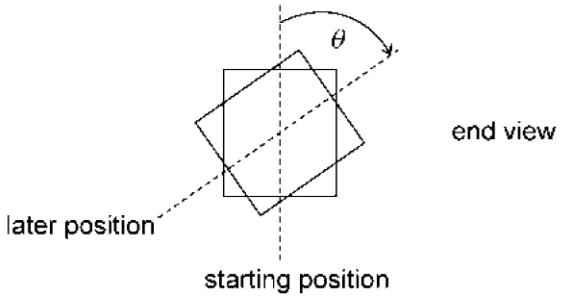
C. $\frac{3T}{4}$

D. T

39 – (PHYSI/12_SL_Summer_2019_Q15) – *Oscillations & Waves*

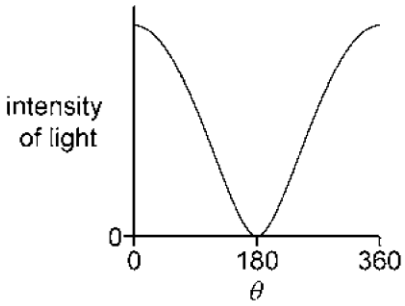
Unpolarized light is incident on two polarizers. The axes of polarization of both polarizers are initially parallel. The second polarizer is then rotated through 360° as shown.



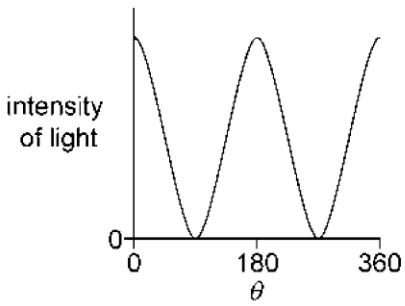


Which graph shows the variation of intensity with angle θ for the light leaving the second polarizer?

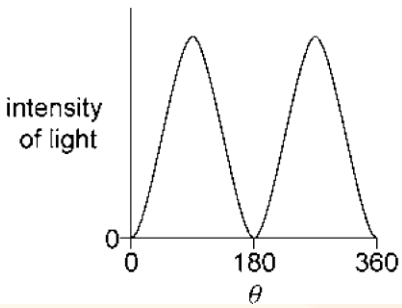
A.



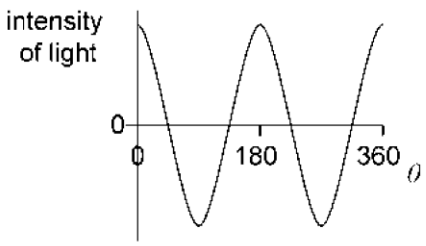
B.



C.

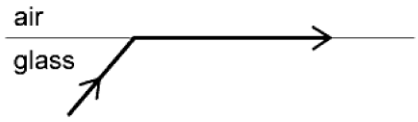


D.



40 – (PHYSI/12_SL_Summer_2019_Q16) – *Oscillations & Waves*

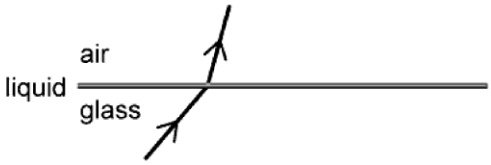
Monochromatic light travelling upwards in glass is incident on a boundary with air. The path of the refracted light is shown.



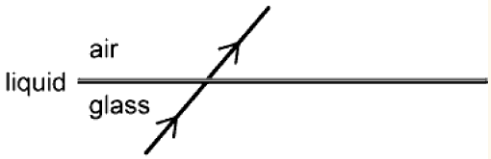
A layer of liquid is then placed on the glass without changing the angle of incidence on the glass. The refractive index of the glass is greater than the refractive index of the liquid and the refractive index of the liquid is greater than that of air.

What is the path of the refracted light when the liquid is placed on the glass?

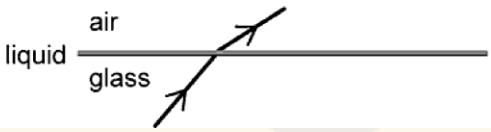
A.



B.



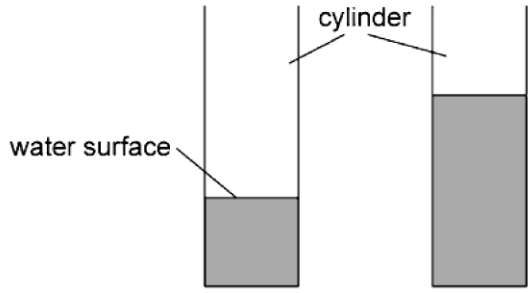
C.



D.

41 – (PHYSI/12_SL_Summer_2019_Q17) – *Oscillations & Waves*

A student blows across the top of a cylinder that contains water. A first-harmonic standing sound wave is produced in the air of the cylinder. More water is then added to the cylinder. The student blows so that a first-harmonic standing wave is produced with a different frequency.



What is the nature of the displacement in the air at the water surface and the change in frequency when the water is added?

	Nature of displacement	Change in frequency
A.	antinode	decrease
B.	antinode	increase
C.	node	decrease
D.	node	increase

42 – (PHYSI/10_SL_Winter_2019_Q12) – *Oscillations & Waves*

The motion of an object is described by the equation

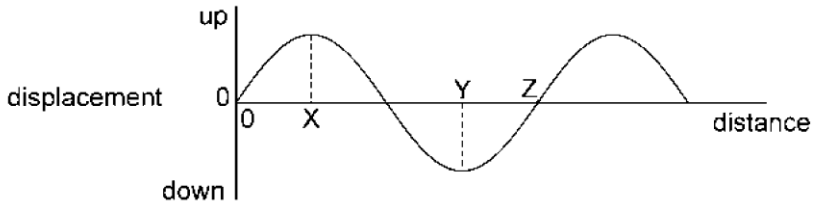
$$\text{acceleration} \propto -\text{displacement}.$$

What is the direction of the acceleration relative to that of the displacement and what is the displacement when the speed is a maximum?

	Direction of acceleration relative to displacement	Displacement when speed is a maximum
A.	same	max
B.	same	zero
C.	opposite	max
D.	opposite	zero

43 – (PHYSI/10_SL_Winter_2019_Q13) – *Oscillations & Waves*

A transverse travelling wave is moving through a medium. The graph shows, for one instant, the variation with distance of the displacement of particles in the medium.



The frequency of the wave is 25 Hz and the speed of the wave is 100 m s^{-1}. What is correct for this wave?

A. The particles at X and Y are in phase.

B. The velocity of the particle at X is a maximum.

C. The horizontal distance between X and Z is 3.0 m.

D. The velocity of the particle at Y is 100 m s^{-1}.

44 – (PHYSI/10_SL_Winter_2019_Q14) – *Oscillations & Waves*

Monochromatic light is used to produce double-slit interference fringes on a screen. The fringe separation on the screen is y. The distance from the slits to the screen and the separation of the slits are both doubled, and the light source is unchanged. What is the new fringe separation on the screen?

A. $\frac{y}{4}$

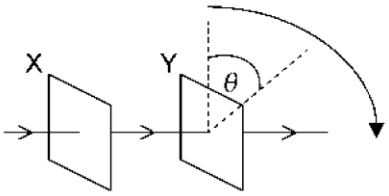
B. y

C. $2y$

D. $4y$

45 – (PHYSI/10_SL_Winter_2019_Q15) – *Oscillations & Waves*

Unpolarized light is incident on two polarizing filters X and Y. They are arranged so that light emerging from Y has a maximum intensity. X is fixed and Y is rotated through θ about the direction of the incident beam in its own plane.



What are the first three successive values of θ for which the final transmitted intensity is a maximum?

A. 90°, 180°, 270°

B. 90°, 270°, 450°

C. 180°, 360°, 540°

D. 180°, 540°, 720°

46 – (PHYSI/10_SL_Winter_2019_Q16) – *Oscillations & Waves*

A pipe is open at both ends. What is correct about a standing wave formed in the air of the pipe?

A. The sum of the number of nodes plus the number of antinodes is an odd number.

B. The sum of the number of nodes plus the number of antinodes is an even number.

C. There is always a central node.

D. There is always a central antinode.

47 – (PHYSI/10_SL_Winter_2020_Q14) – *Oscillations & Waves*

An object moves with simple harmonic motion. The acceleration of the object is

A. constant.

B. always directed away from the centre of the oscillation.

C. a maximum at the centre of the oscillation.

D. a maximum at the extremes of the oscillation.

48 – (PHYSI/10_SL_Winter_2020_Q15) – *Oscillations & Waves*

A travelling wave has a frequency of 500 Hz. The closest distance between two points on the wave that have a phase difference of $60° \left(\frac{\pi}{3}\text{rad}\right)$ is 0.050 m. What is the speed of the wave?

A. $25\,\text{m s}^{-1}$

B. $75\,\text{m s}^{-1}$

C. $150\,\text{m s}^{-1}$

D. $300\,\text{m s}^{-1}$

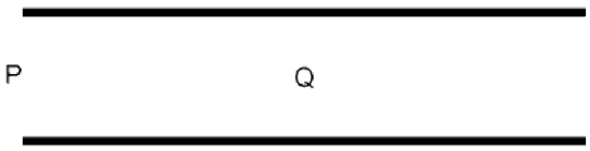
49 – (PHYSI/10_SL_Winter_2020_Q16) – *Oscillations & Waves*

What changes occur to the frequency and wavelength of monochromatic light when it travels from glass to air?

	Frequency	Wavelength
A.	stays the same	stays the same
B.	stays the same	increases
C.	increases	stays the same
D.	decreases	increases

50 – (PHYSI/10_SL_Winter_2020_Q17) – *Oscillations & Waves*

The air in a pipe, open at both ends, vibrates in the second harmonic mode.



What is the phase difference between the motion of a particle at P and the motion of a particle at Q?

A. 0

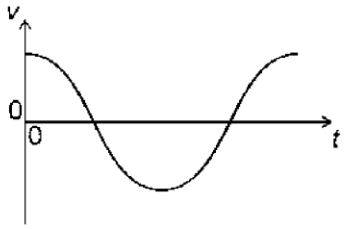
B. $\frac{\pi}{2}$

C. π

D. 2π

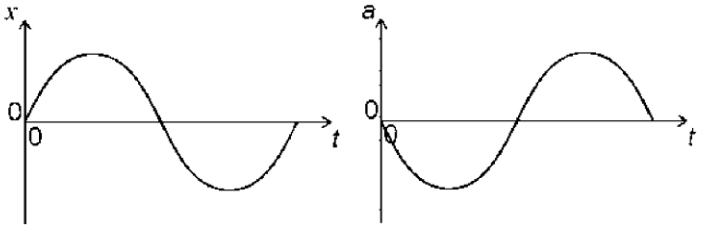
51 – (PHYSI/11_SL_Summer_2021_Q13) – *Oscillations & Waves*

An object performs simple harmonic motion (shm). The graph shows how the velocity v of the object varies with time t.

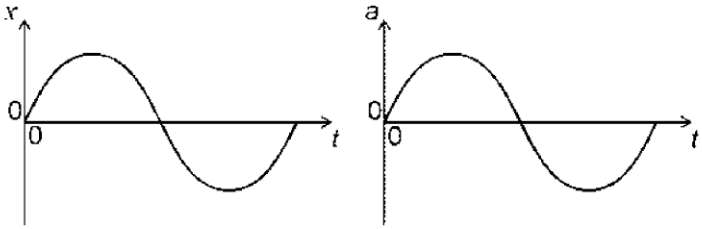


The displacement of the object is x and its acceleration is a. What is the variation of x with t and the variation of a with t?

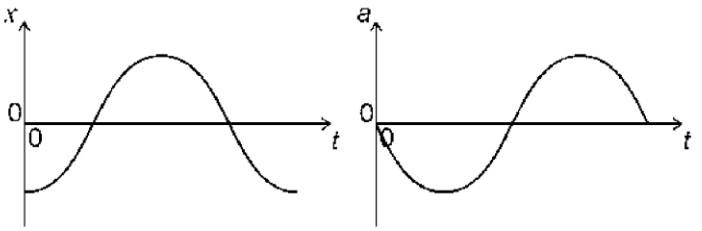
A.



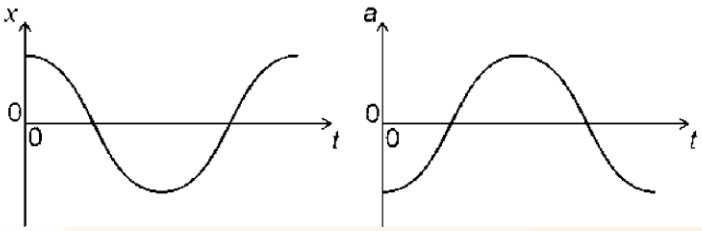
B.



C.



D.



52 – (PHYSI/11_SL_Summer_2021_Q14) – *Oscillations & Waves*

A sound wave has a frequency of 1.0 kHz and a wavelength of 0.33 m. What is the distance travelled by the wave in 2.0 ms and the nature of the wave?

	Distance travelled in 2.0 ms	Nature of the wave
A.	0.17 m	longitudinal
B.	0.17 m	transverse
C.	0.66 m	longitudinal
D.	0.66 m	transverse

53 – (PHYSI/11_SL_Summer_2021_Q15) – *Oscillations & Waves*

Two identical waves, each with amplitude X_0 and intensity I, interfere constructively. What are the amplitude and intensity of the resultant wave?

	Amplitude of the resultant wave	Intensity of the resultant wave
A.	X_0	$2I$
B.	$2X_0$	$2I$
C.	X_0	$4I$
D.	$2X_0$	$4I$

54 – (PHYSI/11_SL_Summer_2021_Q16) – *Oscillations & Waves*

Three quantities used to describe a light wave are

I. frequency
II. wavelength
III. speed.

Which quantities increase when the light wave passes from water to air?

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

55 – (PHYSI/11_SL_Summer_2021_Q17) – *Oscillations & Waves*

A pipe of length L is closed at one end. Another pipe is open at both ends and has length $2L$. What is the lowest common frequency for the standing waves in the pipes?

A. $\frac{\text{speed of sound in air}}{8L}$

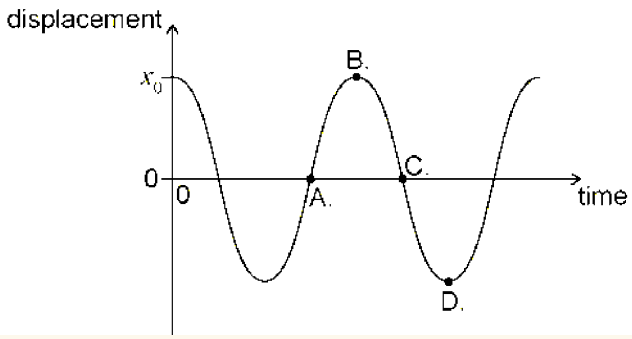
B. $\frac{\text{speed of sound in air}}{4L}$

C. $\frac{\text{speed of sound in air}}{2L}$

D. $\frac{\text{speed of sound in air}}{L}$

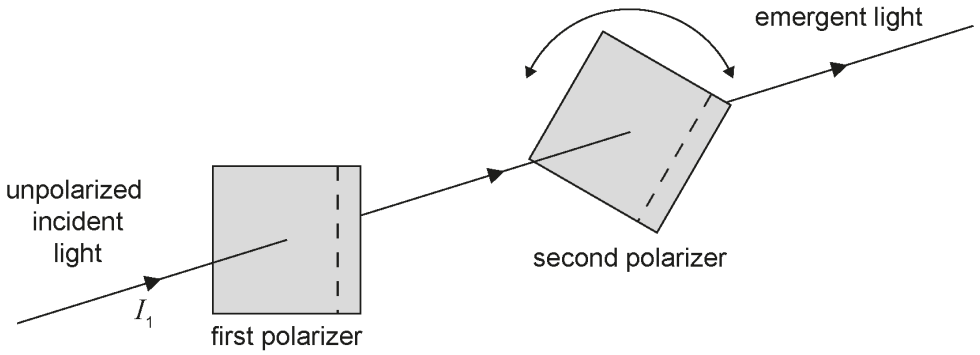
56 – (PHYSI/12_SL_Summer_2021_Q13) – *Oscillations & Waves*

The bob of a pendulum has an initial displacement x_0 to the right. The bob is released and allowed to oscillate. The graph shows how the displacement varies with time. At which point is the velocity of the bob at its maximum magnitude directed towards the left?



57 – (PHYSI/12_SL_Summer_2021_Q14) – *Oscillations & Waves*

Unpolarized light of intensity I_1 is incident on a polarizer. The light that passes through this polarizer then passes through a second polarizer.



The second polarizer can be rotated to vary the intensity of the emergent light. What is the maximum value of the intensity emerging from the second polarizer?

A. $\frac{I_1}{4}$

B. $\frac{I_1}{2}$

C. $\frac{2I_1}{3}$

D. I_1

58 – (PHYSI/12_SL_Summer_2021_Q15) – *Oscillations & Waves*

Two wave generators, placed at position P and position Q, produce water waves with a wavelength of 4.0 cm. Each generator, operating alone, will produce a wave oscillating with an amplitude of 3.0 cm at position R. PR is 42 cm and RQ is 60 cm.

Both wave generators now operate together in phase. What is the amplitude of the resulting wave at R?

A. 9 cm

B. 6 cm

C. 3 cm

D. zero

59 – (PHYSI/12_SL_Summer_2021_Q16) – *Oscillations & Waves*

A glass block has a refractive index in air of n_g. The glass block is placed in two different liquids: liquid X with a refractive index of n_X and liquid Y with a refractive index of n_Y.

In liquid X $\frac{n_g}{n_X} = 2$ and in liquid Y $\frac{n_g}{n_Y} = 1.5$. What is $\frac{\text{speed of light in liquid X}}{\text{speed of light in liquid Y}}$?

A. $\frac{2}{4}$

B. $\frac{3}{4}$

C. $\frac{4}{3}$

D. 3

60 – (PHYSI/12_SL_Summer_2021_Q17) – *Oscillations & Waves*

The frequency of the first harmonic in a pipe is measured. An adjustment is then made which causes the speed of sound in the pipe to increase. What is true for the frequency and the wavelength of the first harmonic when the speed of sound has increased?

	Frequency	Wavelength
A.	increase	unchanged
B.	unchanged	increase
C.	increase	increase
D.	unchanged	unchanged

61 – (PHYSI/10_SL_Winter_2021_Q13) – *Oscillations & Waves*

A particle undergoes simple harmonic motion of amplitude x_0 and frequency f. What is the average speed of the particle during one oscillation?

A. 0

B. $f x_0$

C. $2 f x_0$

D. $4 f x_0$

62 – (PHYSI/10_SL_Winter_2021_Q14) – *Oscillations & Waves*

A travelling wave on the surface of a lake has wavelength λ. Two points along the wave oscillate with the phase difference of π. What is the smallest possible distance between these two points?

A. $\frac{\lambda}{4}$

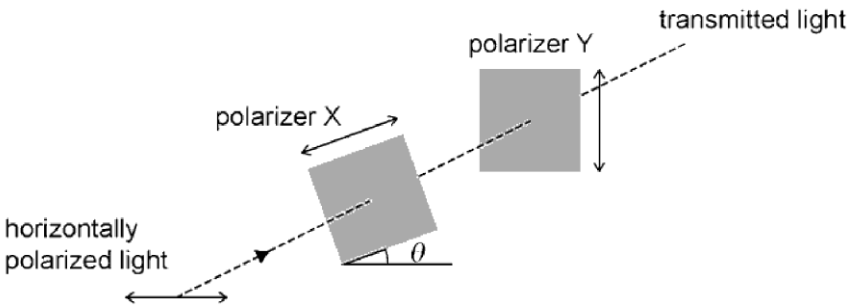
B. $\frac{\lambda}{2}$

C. λ

D. 2λ

63 – (PHYSI/10_SL_Winter_2021_Q15) – *Oscillations & Waves*

Horizontally polarized light is incident on a pair of polarizers X and Y. The axis of polarization of X makes an angle θ with the horizontal. The axis of polarization of Y is vertical.



What is θ so that the intensity of the light transmitted through Y is a maximum?

A. 0°

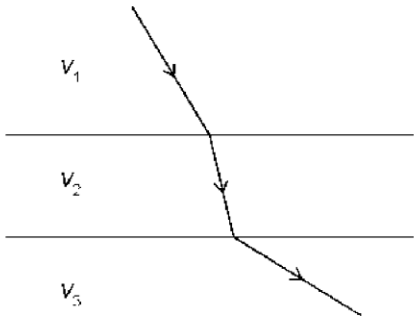
B. 45°

C. 90°

D. 180°

64 – (PHYSI/10_SL_Winter_2021_Q16) – *Oscillations & Waves*

A ray of monochromatic light is incident on the parallel interfaces between three media. The speeds of light in the media are v_1, v_2 and v_3.



What is correct about the speeds of light in the media?

A. $v_3 < v_1 < v_2$

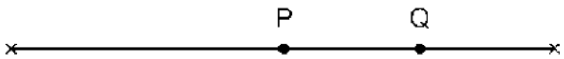
B. $v_3 < v_2 < v_1$

C. $v_2 < v_3 < v_1$

D. $v_2 < v_1 < v_3$

65 – (PHYSI/10_SL_Winter_2021_Q17) – *Oscillations & Waves*

A string is fixed at both ends. P and Q are two particles on the string.



The first harmonic standing wave is formed in the string. What is correct about the motion of P and Q?

A. P is a node and Q is an antinode.

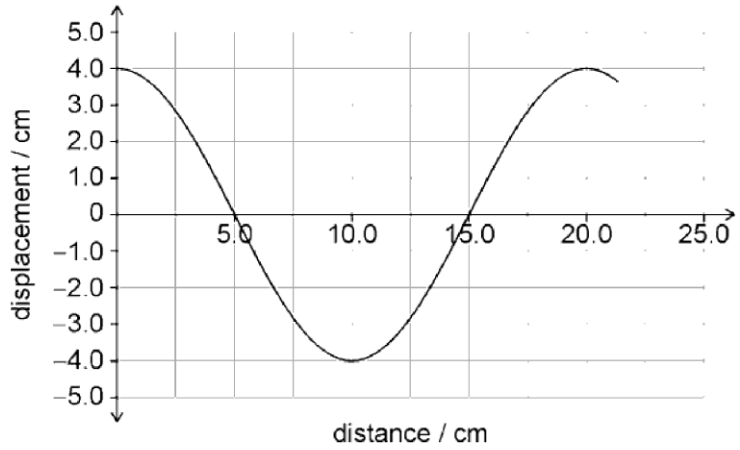
B. P is an antinode and Q is a node.

C. P and Q oscillate with the same amplitude.

D. P and Q oscillate with the same frequency.

66 – (PHYSI/11_SL_Summer_2022_Q13) – *Oscillations & Waves*

A wave of period 10 ms travels through a medium. The graph shows the variation of particle displacement with distance for the wave.



What is the average speed of a particle in the medium during one cycle?

A. $4.0\,m\,s^{1}$

B. $8.0\,m\,s^{-1}$

C. $16\,m\,s^{-1}$

D. $20\,m\,s^{-1}$

67 – (PHYSI/11_SL_Summer_2022_Q14) – *Oscillations & Waves*

A light source of power P is observed from a distance d. The power of the source is then halved.

At what distance from the source will the intensity be the same as before?

A. $\frac{d}{\sqrt{2}}$

B. $\frac{d}{2}$

C. $\frac{d}{4}$

D. $\frac{d}{8}$

68 – (PHYSI/11_SL_Summer_2022_Q15) – *Oscillations & Waves*

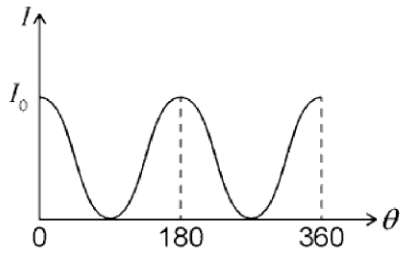
An interference pattern with minima of zero intensity is observed between light waves. What must be true about the frequency and amplitude of the light waves?

	frequency	amplitude
A.	different	different
B.	different	same
C.	same	same
D.	same	different

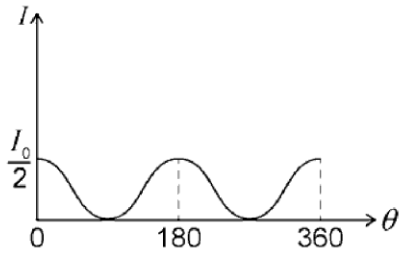
69 – (PHYSI/11_SL_Summer_2022_Q16) – *Oscillations & Waves*

A beam of unpolarized light of intensity I_0 is incident on a polarizing filter. The polarizing filter is rotated through an angle θ. What is the variation in the intensity I of the beam with angle θ after passing through the polarizing filter?

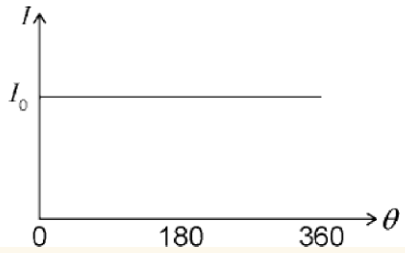
A.



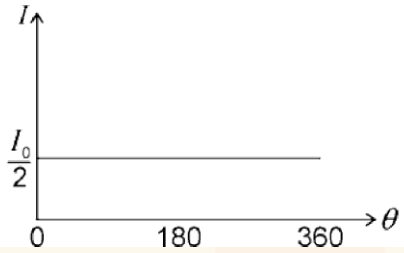
B.



C.

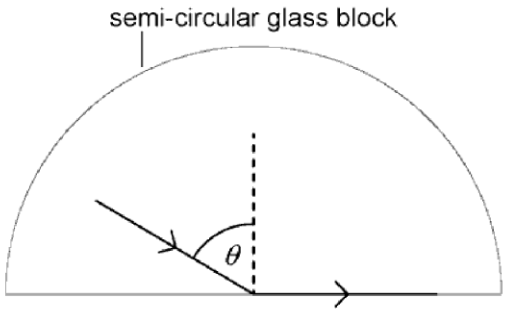


D.



70 – (PHYSI/11_SL_Summer_2022_Q17) – *Oscillations & Waves*

A ray of light is incident on the flat side of a semi-circular glass block placed in paraffin. The ray is totally internally reflected inside the glass block as shown.



The refractive index of glass is n_1 and the refractive index of paraffin is n_2.

What is correct?

A. $\sin\theta = \frac{n_1}{n_2}$

B. $\sin\theta = \frac{n_2}{n_1}$

C. $\sin\theta = \frac{1}{n_1}$

D. $\sin\theta = \frac{1}{n_2}$

71 – (PHYSI/11_SL_Summer_2022_Q18) – *Oscillations & Waves*

A standing wave is formed on a rope. The distance between the first and fifth antinode on the standing wave is 60 cm. What is the wavelength of the wave?

A. 12 cm

B. 15 cm

C. 24 cm

D. 30 cm

72 – (PHYSI/12_SL_Summer_2022_Q14) – *Oscillations & Waves*

A particle is moving in a straight line with an acceleration proportional to its displacement and opposite to its direction. What are the velocity and the acceleration of the particle when it is at its maximum displacement?

	Velocity	Acceleration
A.	maximum	zero
B.	maximum	maximum
C.	zero	zero
D.	zero	maximum

73 – (PHYSI/12_SL_Summer_2022_Q15) – *Oscillations & Waves*

Three statements about electromagnetic waves are:

I. They can be polarized.

II. They can be produced by accelerating electric charges.

III. They must travel at the same velocity in all media.

Which combination of statements is true?

A. I and II only

B. I and III only

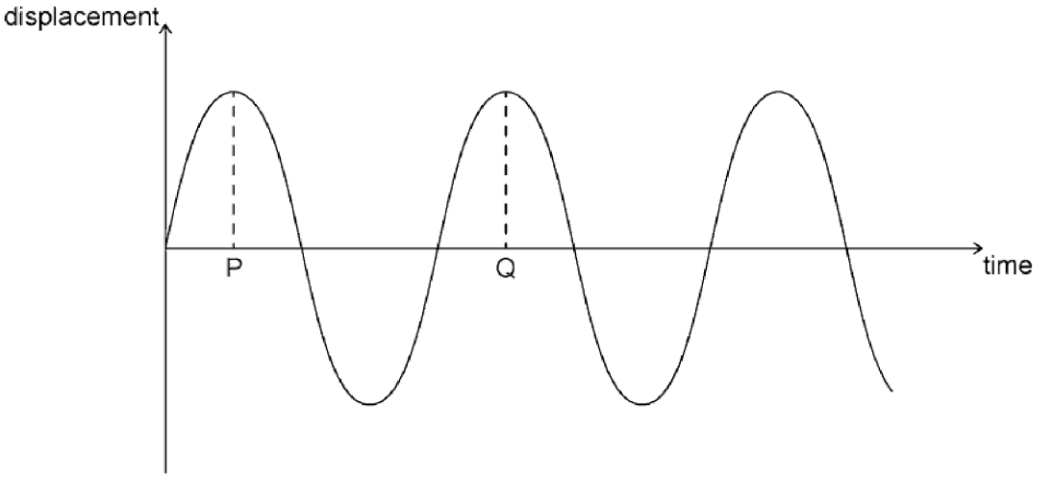
C. II and III only

D. I, II and III

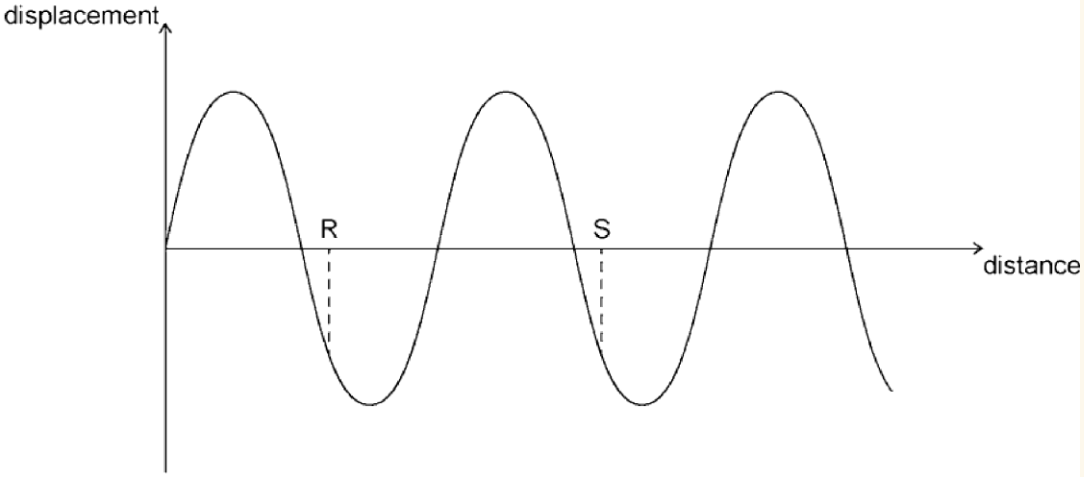
74 – (PHYSI/12_SL_Summer_2022_Q16) – *Oscillations & Waves*

A wave travels along a string. Graph M shows the variation with time of the displacement of a point X on the string. Graph N shows the variation with distance of the displacement of the string. PQ and RS are marked on the graphs.

Graph M



Graph N



What is the speed of the wave?

A. $\frac{PQ}{RS}$

B. $PQ \times RS$

C. $\frac{RS}{PQ}$

D. $\frac{1}{PQ \times RS}$

75 – (PHYSI/12_SL_Summer_2022_Q17) – *Oscillations & Waves*

The refractive index of glass is $\frac{3}{2}$ and the refractive index of water is $\frac{4}{3}$. What is the critical angle for light travelling from glass to water?

A. $\sin^{-1}\left(\frac{1}{2}\right)$

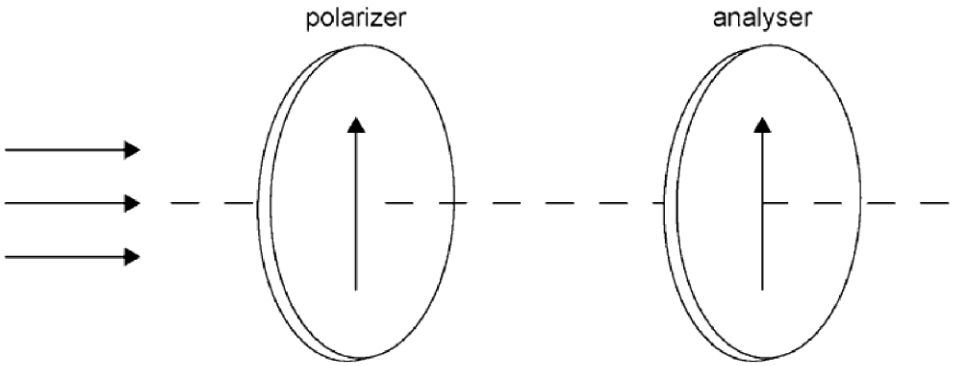
B. $\sin^{-1}\left(\frac{2}{3}\right)$

C. $\sin^{-1}\left(\frac{3}{4}\right)$

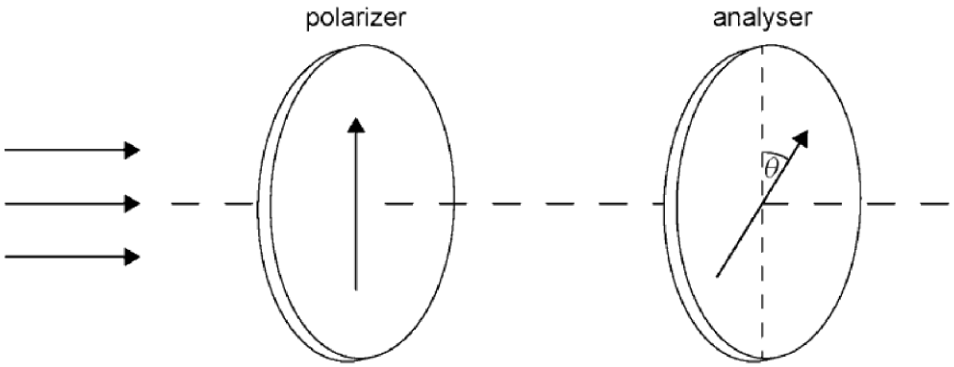
D. $\sin^{-1}\left(\frac{8}{9}\right)$

76 – (PHYSI/12_SL_Summer_2022_Q18) – *Oscillations & Waves*

Unpolarized light with an intensity of $320\,\mathrm{W\,m^{-2}}$ goes through a polarizer and an analyser, originally aligned parallel.



The analyser is rotated through an angle $\theta = 30°$. Cos $30° = \frac{\sqrt{3}}{2}$.



What is the intensity of the light emerging from the analyser?

A. $120\,\mathrm{W\,m^{-2}}$

B. $80\sqrt{3}\,\mathrm{W\,m^{-2}}$

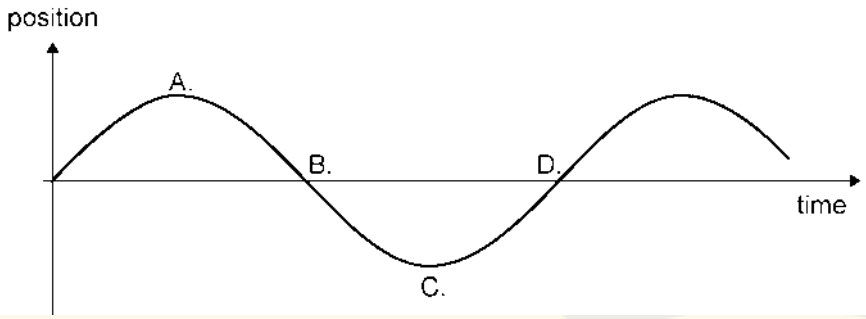
C. $240\,\mathrm{W\,m^{-2}}$

D. $160\sqrt{3}\,\mathrm{W\,m^{-2}}$

77 – (PHYSI/10_SL_Winter_2022_Q11) – *Oscillations & Waves*

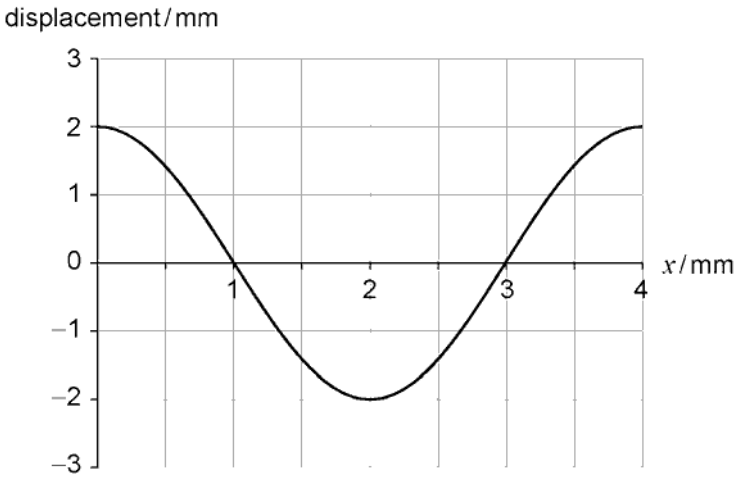
An object oscillates at the free end of a vertical spring. The graph shows the variation of the object's position with time.

At which position does the object have zero velocity and a negative acceleration?



78 – (PHYSI/10_SL_Winter_2022_Q12) – *Oscillations & Waves*

The graph shows the variation with distance x of the displacement of the particles in a wave. The frequency of the wave is 600 Hz.



What is the speed of the wave?

A. $0.012\,m\,s^{-1}$

B. $0.024\,m\,s^{-1}$

C. $1.2\,m\,s^{-1}$

D. $2.4\,m\,s^{-1}$

79 – (PHYSI/10_SL_Winter_2022_Q13) – *Oscillations & Waves*

A point source emits a sound wave of amplitude Z. A person stands a distance L from the source. The amplitude is changed to $2Z$.

What distance must the person move through in order to hear the original intensity again?

A. L

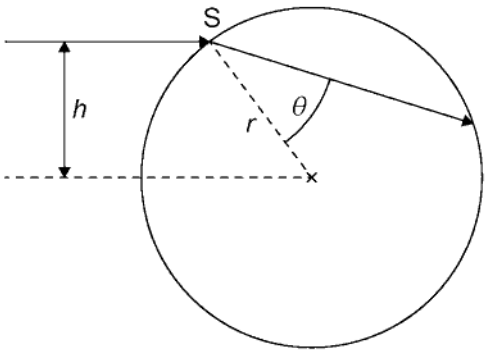
B. $2L$

C. $3L$

D. $7L$

80 – (PHYSI/10_SL_Winter_2022_Q14) – *Oscillations & Waves*

A ray of light enters from air into a water droplet of radius r at point S. S is a vertical distance h from the centre of the droplet. The droplet has a refractive index n and the angle of refraction is θ.



What is $\sin\theta$?

A. $\frac{nh}{r}$

B. $\frac{r}{nh}$

C. $\frac{h}{nr}$

D. $\frac{nr}{h}$

81 – (PHYSI/10_SL_Winter_2022_Q15) – *Oscillations & Waves*

A standing wave is formed in a pipe closed at one end. The third harmonic has a frequency of 400 Hz when the speed of sound is 300 m s ^{1}. What is the length of the pipe?

A. $\frac{3}{16}$ m

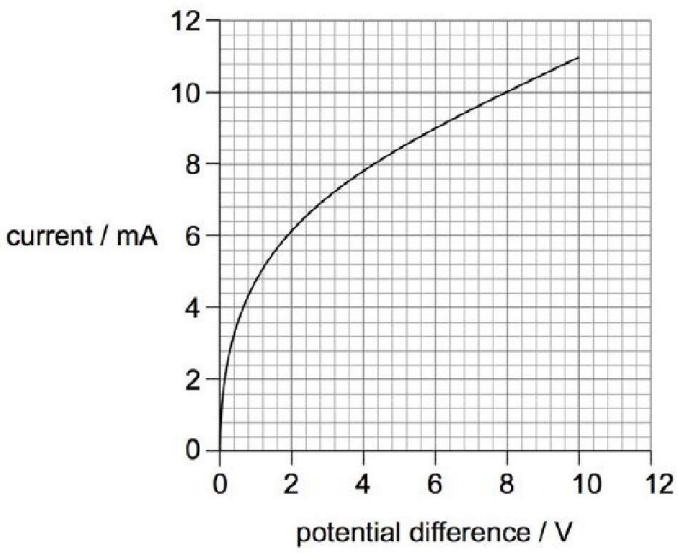
B. $\frac{9}{16}$ m

C. $\frac{3}{4}$ m

D. $\frac{14}{16}$ m

1 – (PHYSI/11_SL_Summer_2017_Q18) – *Electricity & Magnetism*

The graph shows the variation of current with potential difference for a filament lamp.



What is the resistance of the filament when the potential difference across it is 6.0 V?

A. 0.5 mΩ

B. 1.5 mΩ

C. 670 Ω

D. 2000 Ω

2 – (PHYSI/11_SL_Summer_2017_Q19) – *Electricity & Magnetism*

An electron is accelerated through a potential difference of 2.5 MV. What is the change in kinetic energy of the electron?

A. 0.4 μJ

B. 0.4 nJ

C. 0.4 pJ

D. 0.4 fJ

3 – (PHYSI/11_SL_Summer_2017_Q20) – *Electricity & Magnetism*

A cell is connected in series with a resistor and supplies a current of 4.0 A for a time of 500 s. During this time, 1.5 kJ of energy is dissipated in the cell and 2.5 kJ of energy is dissipated in the resistor.

What is the emf of the cell?

A. 0.50 V

B. 0.75 V

C. 1.5 V

D. 2.0 V

4 – (PHYSI/11_SL_Summer_2017_Q21) – *Electricity & Magnetism*

An electron travelling at speed *v* perpendicular to a magnetic field of strength *B* experiences a force *F*.

What is the force acting on an alpha particle travelling at 2*v* parallel to a magnetic field of strength 2*B*?

A. 0

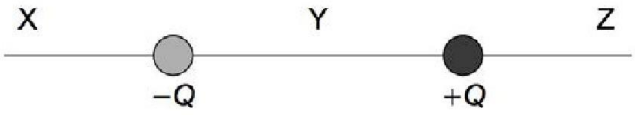
B. 2*F*

C. 4*F*

D. 8*F*

5 – (PHYSI/12_SL_Summer_2017_Q18) – *Electricity & Magnetism*

The diagram shows two equal and opposite charges that are fixed in place.



At which points is the net electric field directed to the right?

A. X and Y only

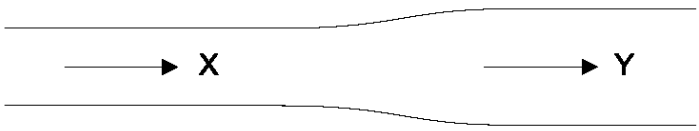
B. Z and Y only

C. X and Z only

D. X, Y and Z

6 – (PHYSI/12_SL_Summer_2017_Q19) – *Electricity & Magnetism*

A wire has variable cross-sectional area. The cross-sectional area at Y is double that at X.

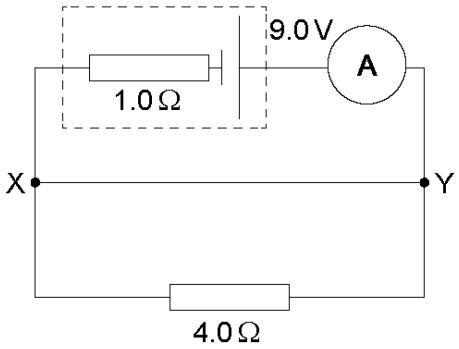


At X, the current in the wire is I and the electron drift speed is v. What is the current and the electron drift speed at Y?

	Current	Drift speed
A.	I	v
B.	I	$\frac{v}{2}$
C.	$2I$	v
D.	$2I$	$\frac{v}{2}$

7 – (PHYSI/12_SL_Summer_2017_Q20) – *Electricity & Magnetism*

A circuit contains a cell of electromotive force (emf) 9.0 V and internal resistance 1.0 Ω together with a resistor of resistance 4.0 Ω as shown. The ammeter is ideal. XY is a connecting wire.



What is the reading of the ammeter?

A. 0 A

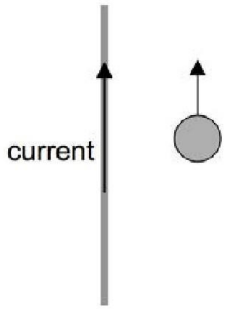
B. 1.8 A

C. 9.0 A

D. 11 A

8 – (PHYSI/12_SL_Summer_2017_Q21) – *Electricity & Magnetism*

A positively-charged particle moves parallel to a wire that carries a current upwards.



What is the direction of the magnetic force on the particle?

A. To the left

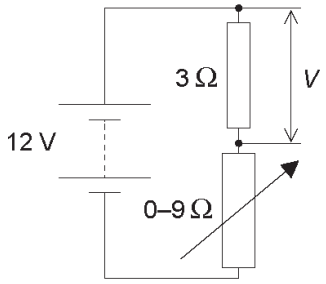
B. To the right

C. Into the page

D. Out of the page

9 – (PHYSI/10_SL_Winter_2017_Q17) – *Electricity & Magnetism*

In the circuit shown, the fixed resistor has a value of 3 Ω and the variable resistor can be varied between 0 Ω and 9 Ω.



The power supply has an emf of 12 V and negligible internal resistance. What is the difference between the maximum and minimum values of voltage *V* across the 3 Ω resistor?

A. 3 V

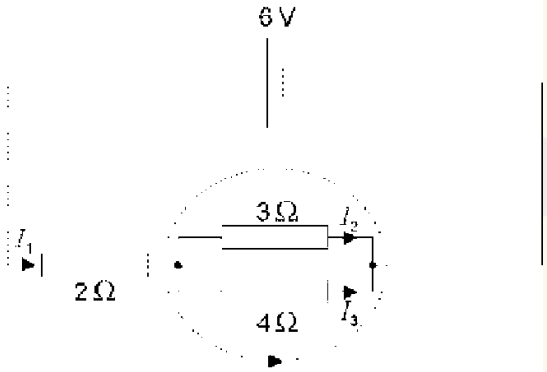
B. 6 V

C. 9 V

D. 12 V

10 – (PHYSI/10_SL_Winter_2017_Q18) – *Electricity & Magnetism*

Kirchhoff's laws are applied to the circuit shown.



What is the equation for the dotted loop?

A. $0 \quad 3I_2 \cdot 4I_3$

B. $0-4I_3 \quad 3I_2$

C. $6=2I_1-3I_2+4I_3$

D. $6=3I_2 \cdot 4I_3$

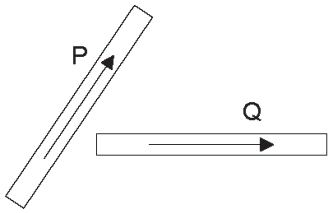
11 – (PHYSI/10_SL_Winter_2017_Q19) – *Electricity & Magnetism*

With reference to internal energy conversion and ability to be recharged, what are the characteristics of a primary cell?

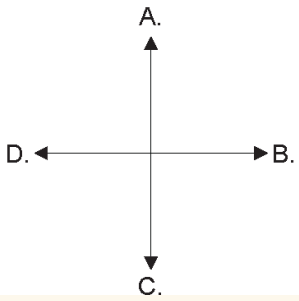
	Internal energy conversion	Ability to be recharged
A.	chemical to electrical	rechargeable
B.	chemical to electrical	not rechargeable
C.	electrical to chemical	rechargeable
D.	electrical to chemical	not rechargeable

12 – (PHYSI/10_SL_Winter_2017_Q20) – *Electricity & Magnetism*

The diagram shows two current-carrying wires, P and Q, that both lie in the plane of the paper. The arrows show the conventional current direction in the wires.

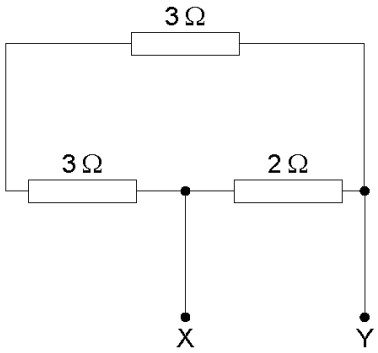


The electromagnetic force on Q is in the same plane as that of the wires. What is the direction of the electromagnetic force acting on Q?



13 – (PHYSI/11_SL_Summer_2018_Q18) – *Electricity & Magnetism*

Three resistors are connected as shown. What is the value of the total resistance between X and Y?



A. 1.5 Ω

B. 1.9 Ω

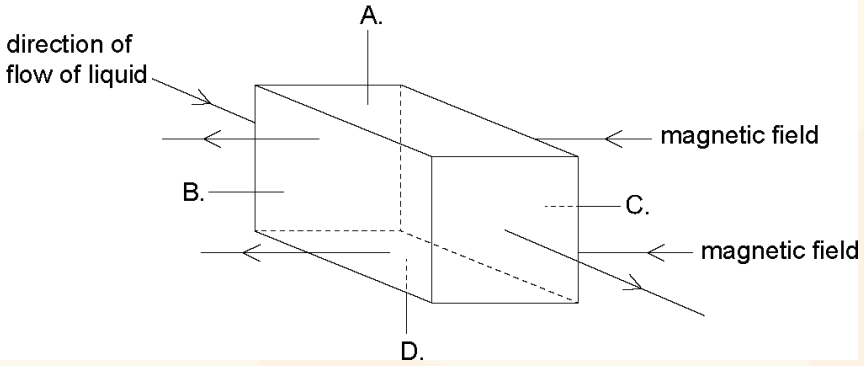
C. 6.0 Ω

D. 8.0 Ω

14 – (PHYSI/11_SL_Summer_2018_Q19) – *Electricity & Magnetism*

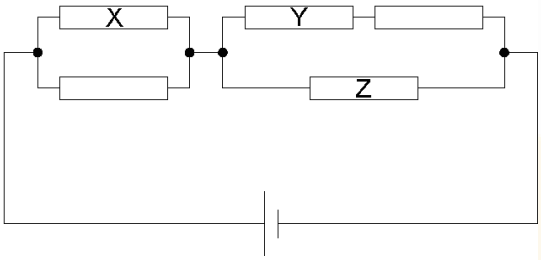
A liquid that contains negative charge carriers is flowing through a square pipe with sides A, B, C and D. A magnetic field acts in the direction shown across the pipe.

On which side of the pipe does negative charge accumulate?



15 – (PHYSI/11_SL_Summer_2018_Q20) – *Electricity & Magnetism*

Five resistors of equal resistance are connected to a cell as shown.



What is correct about the power dissipated in the resistors?

A. The power dissipated is greatest in resistor X.

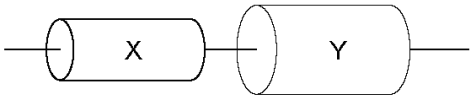
B. The power dissipated is greatest in resistor Y.

C. The power dissipated is greatest in resistor Z.

D. The power dissipated is the same in all resistors.

16 – (PHYSI/11_SL_Summer_2018_Q21) – *Electricity & Magnetism*

Two resistors X and Y are made of uniform cylinders of the same material. X and Y are connected in series. X and Y are of equal length and the diameter of Y is twice the diameter of X.



The resistance of Y is R.

What is the resistance of this series combination?

A. $\frac{5R}{4}$

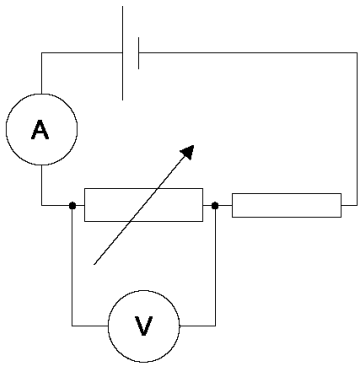
B. $\frac{3R}{2}$

C. $3R$

D. $5R$

17 – (PHYSI/12_SL_Summer_2018_Q19) – *Electricity & Magnetism*

A cell with negligible internal resistance is connected as shown. The ammeter and the voltmeter are both ideal.

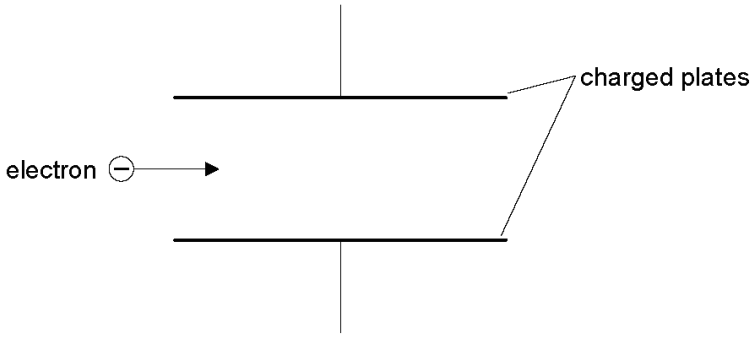


What changes occur in the ammeter reading and in the voltmeter reading when the resistance of the variable resistor is increased?

	Change in ammeter reading	Change in voltmeter reading
A.	increases	increases
B.	increases	decreases
C.	decreases	increases
D.	decreases	decreases

18 – (PHYSI/12_SL_Summer_2018_Q20) – *Electricity & Magnetism*

An electron enters the region between two charged parallel plates initially moving parallel to the plates.



The electromagnetic force acting on the electron

A. causes the electron to decrease its horizontal speed.

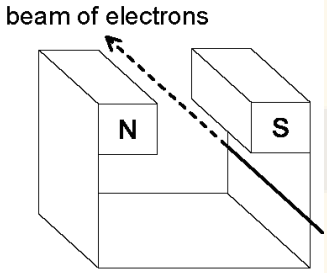
B. causes the electron to increase its horizontal speed.

C. is parallel to the field lines and in the opposite direction to them.

D. is perpendicular to the field direction.

19 – (PHYSI/12_SL_Summer_2018_Q21) – *Electricity & Magnetism*

A beam of electrons moves between the poles of a magnet.



What is the direction in which the electrons will be deflected?

A. Downwards

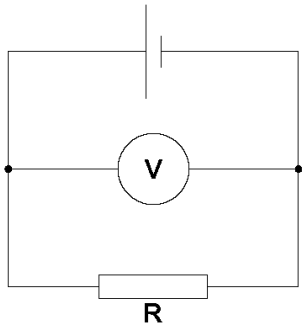
B. Towards the N pole of the magnet

C. Towards the S pole of the magnet

D. Upwards

20 – (PHYSI/12_SL_Summer_2018_Q22) – *Electricity & Magnetism*

A cell has an emf of 4.0 V and an internal resistance of 2.0 Ω. The ideal voltmeter reads 3.2 V.



What is the resistance of R?

A. 0.8 Ω

B. 2.0 Ω

C. 4.0 Ω

D. 8.0 Ω

21 – (PHYSI/10_SL_Winter_2018_Q19) – *Electricity & Magnetism*

A wire of length *L* is used in an electric heater. When the potential difference across the wire is 200 V, the power dissipated in the wire is 1000 W. The same potential difference is applied across a second similar wire of length 2*L*. What is the power dissipated in the second wire?

A. 250 W

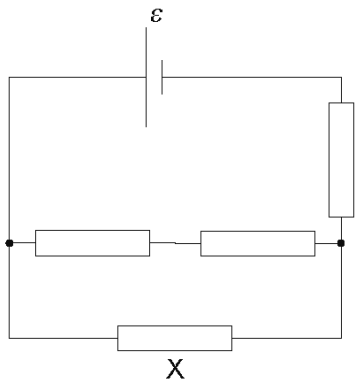
B. 500 W

C. 2000 W

D. 4000 W

22 – (PHYSI/10_SL_Winter_2018_Q20) – *Electricity & Magnetism*

A combination of four identical resistors each of resistance R are connected to a source of emf ε of negligible internal resistance. What is the current in the resistor X?



A. $\frac{\varepsilon}{5R}$

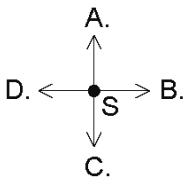
B. $\frac{3\varepsilon}{10R}$

C. $\frac{2\varepsilon}{5R}$

D. $\frac{3\varepsilon}{5R}$

23 – (PHYSI/10_SL_Winter_2018_Q21) – *Electricity & Magnetism*

Two parallel wires are perpendicular to the page. The wires carry equal currents in opposite directions. Point S is at the same distance from both wires. What is the direction of the magnetic field at point S?

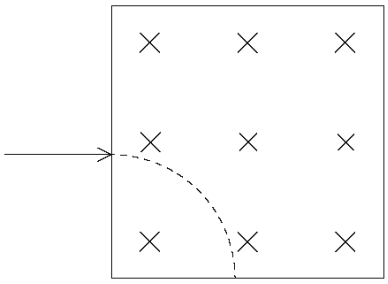


⊙ conventional current out of page

⊗ conventional current into page

24 – (PHYSI/10_SL_Winter_2018_Q22) – *Electricity & Magnetism*

A particle of mass m and charge of magnitude q enters a region of uniform magnetic field B that is directed into the page. The particle follows a circular path of radius R. What are the sign of the charge of the particle and the speed of the particle?

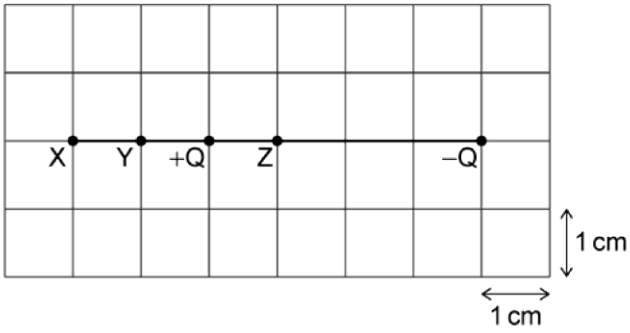


	Charge of the particle	Speed of the particle
A.	positive	$\frac{qBR}{m}$
B.	negative	$\frac{qBR}{m}$
C.	negative	$\sqrt{\frac{qBR}{m}}$
D.	positive	$\sqrt{\frac{qBR}{m}}$

25 – (PHYSI/11_SL_Summer_2019_Q20) – *Electricity & Magnetism*

Two charges, +Q and –Q, are placed as shown.

What is the magnitude of the electric field strength, in descending order, at points X, Y and Z.



A. YXZ

B. ZXY

C. ZYX

D. YZX

26 – (PHYSI/11_SL_Summer_2019_Q21) – *Electricity & Magnetism*

Two cells each of emf 9.0 V and internal resistance 3.0 Ω are connected in series. A 12.0 Ω resistor is connected in series to the cells. What is the current in the resistor?

A. 0.50A

B. 0.75A

C. 1.0A

D. 1.5A

27 – (PHYSI/11_SL_Summer_2019_Q22) – *Electricity & Magnetism*

Charge flows through a liquid. The charge flow is made up of positive and negative ions. In one second 0.10 C of negative ions flow in one direction and 0.10 C of positive ions flow in the opposite direction.

What is the magnitude of the electric current flowing through the liquid?

A. 0A

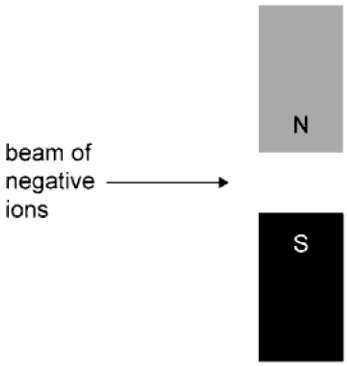
B. 0.05A

C. 0.10A

D. 0.20A

28 – (PHYSI/11_SL_Summer_2019_Q23) – *Electricity & Magnetism*

A beam of negative ions flows in the plane of the page through the magnetic field due to two bar magnets.



What is the direction in which the negative ions will be deflected?

A. Out of the page ⊙

B. Into the page X

C. Up the page ↑

D. Down the page ↓

29 – (PHYSI/12_SL_Summer_2019_Q18) – *Electricity & Magnetism*

A particle with a charge *ne* is accelerated through a potential difference *V*.

What is the magnitude of the work done on the particle?

A. eV

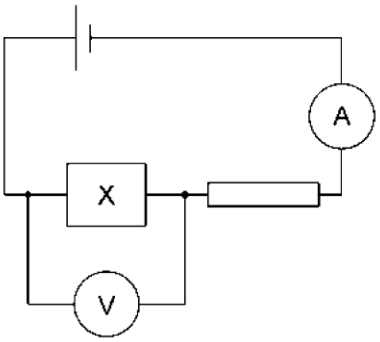
B. neV

C. $\frac{nV}{e}$

D. $\frac{eV}{n}$

30 – (PHYSI/12_SL_Summer_2019_Q19) – *Electricity & Magnetism*

The resistance of component X decreases when the intensity of light incident on it increases. X is connected in series with a cell of negligible internal resistance and a resistor of fixed resistance. The ammeter and voltmeter are ideal.

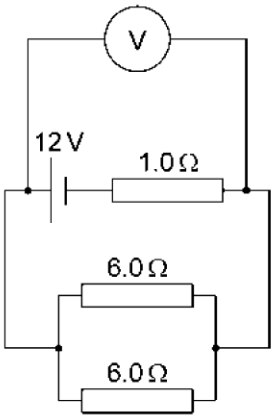


What is the change in the reading on the ammeter and the change in the reading on the voltmeter when the light incident on X is increased?

	Ammeter reading	Voltmeter reading
A.	increases	decreases
B.	increases	increases
C.	decreases	decreases
D.	decreases	increases

31 – (PHYSI/12_SL_Summer_2019_Q20) – *Electricity & Magnetism*

Three resistors of resistance 1.0 Ω, 6.0 Ω and 6.0 Ω are connected as shown. The voltmeter is ideal and the cell has an emf of 12 V with negligible internal resistance.



What is the reading on the voltmeter?

A. 3.0 V

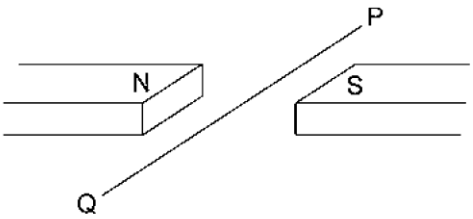
B. 4.0 V

C. 8.0 V

D. 9.0 V

32 – (PHYSI/12_SL_Summer_2019_Q21) – *Electricity & Magnetism*

A horizontal wire PQ lies perpendicular to a uniform horizontal magnetic field.



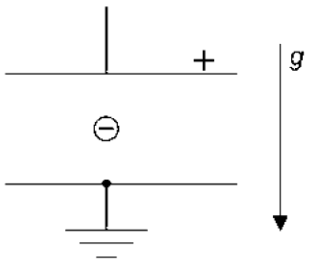
A length of 0.25 m of the wire is subject to a magnetic field strength of 40 mT. A downward magnetic force of 60 mN acts on the wire.

What is the magnitude and direction of the current in the wire?

	Current magnitude / A	Current direction
A.	6.0	P to Q
B.	6.0	Q to P
C.	0.17	Q to P
D.	0.17	P to Q

33 – (PHYSI/10_SL_Winter_2019_Q17) – *Electricity & Magnetism*

A negatively charged particle in a uniform gravitational field is positioned mid-way between two charged conducting plates.



The potential difference between the plates is adjusted until the particle is held at rest relative to the plates.

What change will cause the particle to accelerate downwards relative to the plates?

A. Decreasing the charge on the particle

B. Decreasing the separation of the plates

C. Increasing the length of the plates

D. Increasing the potential difference between the plates

34 – (PHYSI/10_SL_Winter_2019_Q18) – *Electricity & Magnetism*

A thin copper wire and a thick copper wire are connected in series to an electric cell. Which quantity will be greater in the thin wire?

A. Current

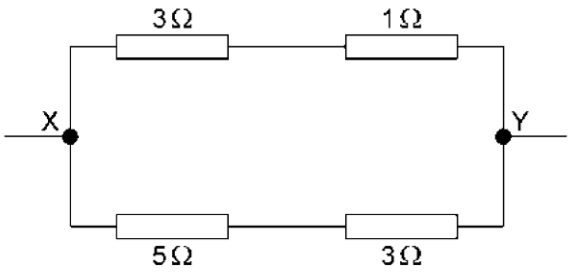
B. Number of free charge carriers per unit volume

C. Net number of charge carriers crossing a section of a wire every second

D. Drift speed of the charge carriers

35 – (PHYSI/10_SL_Winter_2019_Q19) – *Electricity & Magnetism*

The diagram shows a resistor network. The potential difference between X and Y is 8.0 V.



What is the current in the 5Ω resistor?

A. 1.0A

B. 1.6A

C. 2.0A

D. 3.0A

36 – (PHYSI/10_SL_Winter_2019_Q20) – *Electricity & Magnetism*

When a wire with an electric current *I* is placed in a magnetic field of strength *B* it experiences a magnetic force *F*. What is the direction of *F*?

A. In a direction determined by *I* only

B. In a direction determined by *B* only

C. In the plane containing *I* and *B*

D. At 90° to the plane containing *I* and *B*

37 – (PHYSI/10_SL_Winter_2020_Q18) – *Electricity & Magnetism*

A metal wire has *n* free charge carriers per unit volume. The charge on the carrier is *q*. What additional quantity is needed to determine the current per unit area in the wire?

A. Cross-sectional area of the wire

B. Drift speed of charge carriers

C. Potential difference across the wire

D. Resistivity of the metal

38 – (PHYSI/10_SL_Winter_2020_Q19) – *Electricity & Magnetism*

An electric motor raises an object of weight 500 N through a vertical distance of 3.0 m in 1.5 s. The current in the electric motor is 10 A at a potential difference of 200 V. What is the efficiency of the electric motor?

A. 17 %

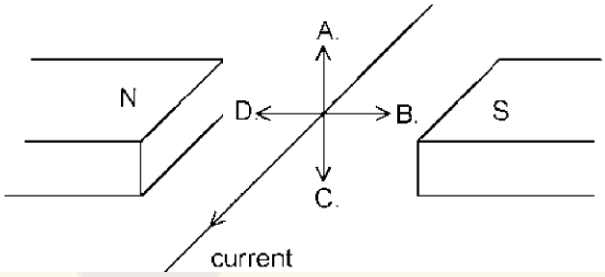
B. 38 %

C. 50 %

D. 75 %

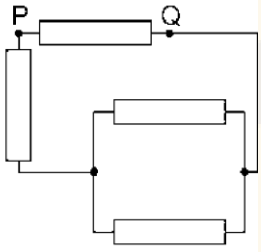
39 – (PHYSI/10_SL_Winter_2020_Q20) – *Electricity & Magnetism*

A current in a wire lies between the poles of a magnet. What is the direction of the electromagnetic force on the wire?



40 – (PHYSI/10_SL_Winter_2020_Q21) – *Electricity & Magnetism*

Four resistors of 4 Ω each are connected as shown.



What is the effective resistance between P and Q?

A. 1.0 Ω

B. 2.4 Ω

C. 3.4 Ω

D. 4.0 Ω

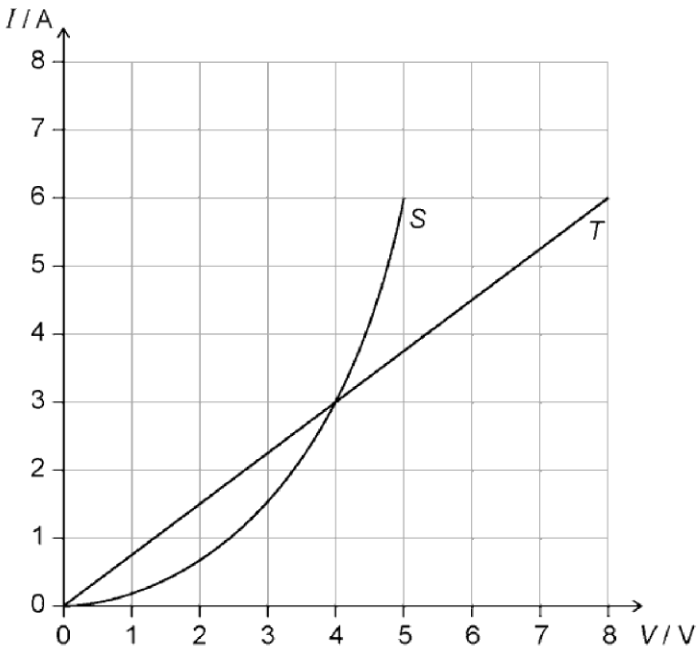
41 – (PHYSI/11_SL_Summer_2021_Q18) – *Electricity & Magnetism*

Two charges Q_1 and Q_2, each equal to 2 nC, are separated by a distance 3 m in a vacuum. What is the electric force on Q_2 and the electric field due to Q_1 at the position of Q_2?

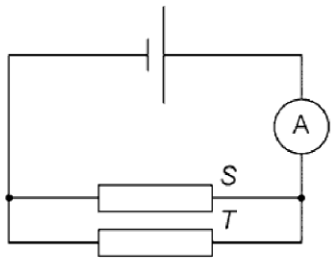
	Electric force on Q_2	Electric field due to Q_1 at the position of Q_2
A.	4×10^{-9} N	2 N C^{-1}
B.	4 N	2 N C^{-1}
C.	4×10^{9} N	2×10^{9} N C^{-1}
D.	4 N	2×10^{9} N C^{-1}

42 – (PHYSI/11_SL_Summer_2021_Q19) – *Electricity & Magnetism*

Two conductors *S* and *T* have the *V*/*I* characteristic graphs shown below.



When the conductors are placed in the circuit below, the reading of the ammeter is 6.0A.



What is the emf of the cell?

A. 4.0V

B. 5.0V

C. 8.0V

D. 13V

43 – (PHYSI/11_SL_Summer_2021_Q20) – *Electricity & Magnetism*

For a real cell in a circuit, the terminal potential difference is at its closest to the emf when

A. the internal resistance is much smaller than the load resistance.

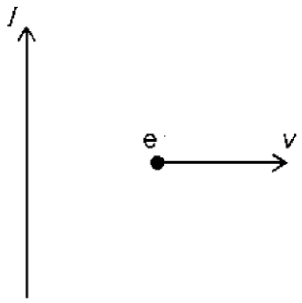
B. a large current flows in the circuit.

C. the cell is not completely discharged.

D. the cell is being recharged.

44 – (PHYSI/11_SL_Summer_2021_Q21) – *Electricity & Magnetism*

A long straight vertical conductor carries a current *I* upwards. An electron moves with horizontal speed *v* to the right.



What is the direction of the magnetic force on the electron?

A. Downwards

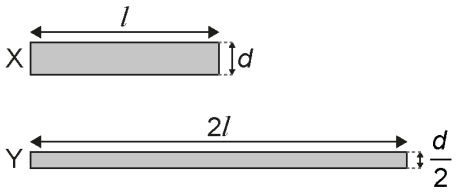
B. Upwards

C. Into the page

D. Out of the page

45 – (PHYSI/12_SL_Summer_2021_Q18) – *Electricity & Magnetism*

The diagram shows two cylindrical wires, X and Y. Wire X has a length l, a diameter d, and a resistivity ρ. Wire Y has a length $2l$, a diameter of $\frac{d}{2}$ and a resistivity of $\frac{\rho}{2}$.



What is $\frac{\text{resistance of X}}{\text{resistance of Y}}$?

A. 4

B. 2

C. 0.5

D. 0.25

46 – (PHYSI/12_SL_Summer_2021_Q19) – *Electricity & Magnetism*

An ion moves in a circle in a uniform magnetic field. Which single change would increase the radius of the circular path?

A. Decreasing the speed of the ion

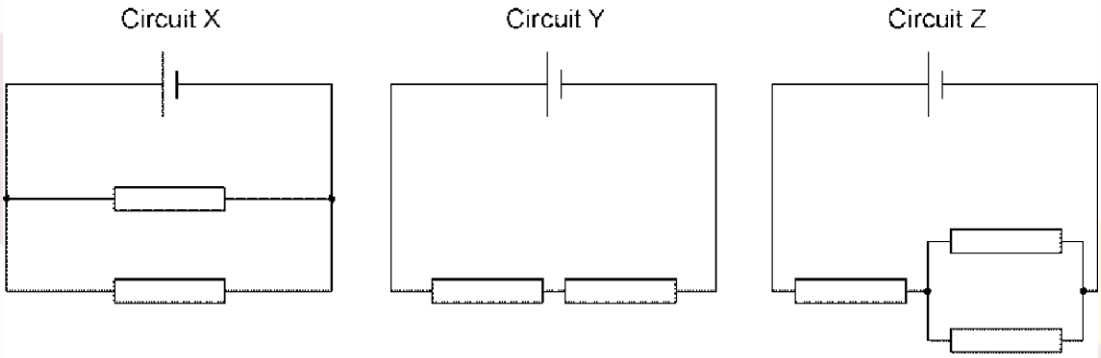
B. Increasing the charge of the ion

C. Increasing the mass of the ion

D. Increasing the strength of the magnetic field

47 – (PHYSI/12_SL_Summer_2021_Q20) – *Electricity & Magnetism*

In the circuits shown, the cells have the same emf and zero internal resistance. All resistors are identical.

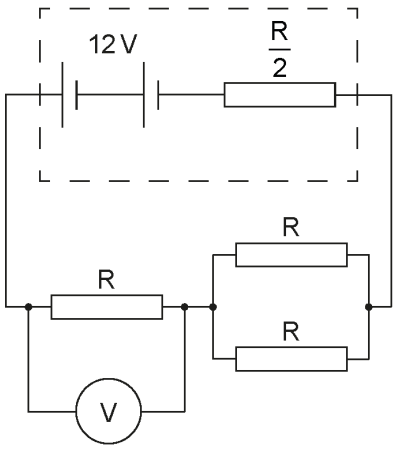


What is the order of increasing power dissipated in each circuit?

	Lowest → Highest power dissipated
A.	Y, Z, X
B.	X, Y, Z
C.	X, Z, Y
D.	Y, X, Z

48 – (PHYSI/12_SL_Summer_2021_Q21) – *Electricity & Magnetism*

Three identical resistors of resistance R are connected as shown to a battery with a potential difference of 12 V and an internal resistance of $\frac{R}{2}$. A voltmeter is connected across one of the resistors.



What is the reading on the voltmeter?

A. 3 V

B. 4 V

C. 6 V

D. 8 V

49 – (PHYSI/12_SL_Summer_2021_Q22) – *Electricity & Magnetism*

Magnetic field lines are an example of

A. a discovery that helps us understand magnetism.

B. a model to aid in visualization.

C. a pattern in data from experiments.

D. a theory to explain concepts in magnetism.

50 – (PHYSI/12_SL_Summer_2021_Q23) – *Electricity & Magnetism*

An object moves in a circle of constant radius. Values of the centripetal force F are measured for different values of angular velocity ω. A graph is plotted with ω on the x-axis. Which quantity plotted on the y-axis will produce a straight-line graph?

A. $\sqrt{F}$

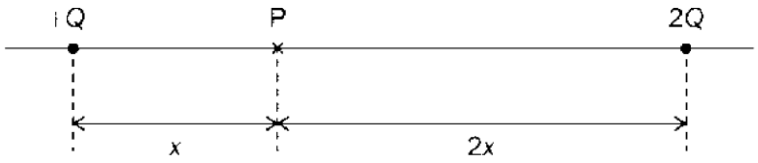
B. F

C. F^2

D. $\frac{1}{F}$

51 – (PHYSI/10_SL_Winter_2021_Q18) – *Electricity & Magnetism*

A charge $+Q$ and a charge $-2Q$ are a distance $3x$ apart. Point P is on the line joining the charges, at a distance x from $+Q$.



The magnitude of the electric field produced at P by the charge $+Q$ alone is E.

What is the total electric field at P?

A. $\frac{E}{2}$ to the right

B. $\frac{E}{2}$ to the left

C. $\frac{3E}{2}$ to the right

D. $\frac{3E}{2}$ to the left

52 – (PHYSI/10_SL_Winter_2021_Q19) – *Electricity & Magnetism*

Two wires, X and Y, are made of the same material and have equal length. The diameter of X is twice that of Y.

What is $\frac{\text{resistance of X}}{\text{resistance of Y}}$?

A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. 2

D. 4

53 – (PHYSI/10_SL_Winter_2021_Q20) – *Electricity & Magnetism*

An electric motor of efficiency 0.75 is connected to a power supply with an emf of 20 V and negligible internal resistance. The power output of the motor is 120 W. What is the average current drawn from the power supply?

A. 3.1A

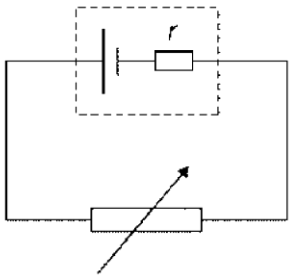
B. 4.5A

C. 6.0A

D. 8.0A

54 – (PHYSI/10_SL_Winter_2021_Q21) – *Electricity & Magnetism*

A variable resistor is connected in series to a cell with internal resistance *r* as shown.

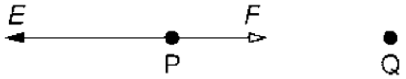


The resistance of the variable resistor is increased. What happens to the power dissipated in the cell and to the terminal potential difference of the cell?

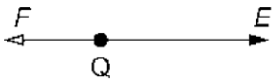
	Power dissipated in the cell	Terminal potential difference of the cell
A.	decreases	increases
B.	increases	increases
C.	decreases	decreases
D.	increases	decreases

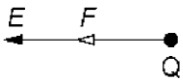
55 – (PHYSI/11_SL_Summer_2022_Q19) – *Electricity & Magnetism*

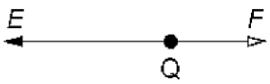
P and Q are two opposite point charges. The force *F* acting on P due to Q and the electric field strength *E* at P are shown.

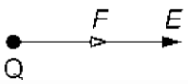


Which diagram shows the force on Q due to P and the electric field strength at Q?

A.


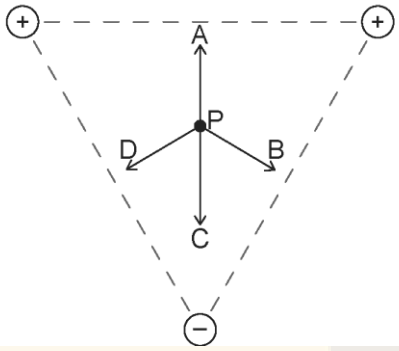
B.


C.


D.


56 – (PHYSI/11_SL_Summer_2022_Q20) – *Electricity & Magnetism*

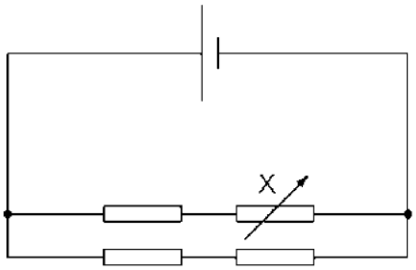
Three point charges of equal magnitude are placed at the vertices of an equilateral triangle. The signs of the charges are shown. Point P is equidistant from the vertices of the triangle. What is the direction of the resultant electric field at P?



57 – (PHYSI/11_SL_Summer_2022_Q21) – *Electricity & Magnetism*

Three identical resistors each of resistance R are connected with a variable resistor X as shown. X is initially set to R. The current in the cell is 0.60 A.

The cell has negligible internal resistance.



X is now set to zero. What is the current in the cell?

A. 0.45 A

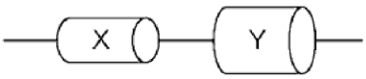
B. 0.60 A

C. 0.90 A

D. 1.80 A

58 – (PHYSI/11_SL_Summer_2022_Q22) – *Electricity & Magnetism*

Two cylinders, X and Y, made from the same material, are connected in series.



The cross-sectional area of Y is twice that of X. The drift speed of the electrons in X is v_X and in Y it is v_Y.

What is the ratio $\frac{v_X}{v_Y}$?

A. 4

B. 2

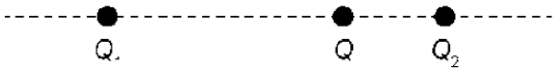
C. 1

D. $\frac{1}{2}$

59 – (PHYSI/12_SL_Summer_2022_Q19) – *Electricity & Magnetism*

A charge Q is at a point between two electric charges Q_1 and Q_2. The net electric force on Q is zero. Charge Q_1 is further from Q than charge Q_2.

What is true about the signs of the charges Q_1 and Q_2 and their magnitudes?



	Signs of charges Q_1 and Q_2	Magnitudes
A.	same	$Q_1 > Q_2$
B.	same	$Q_1 < Q_2$
C.	opposite	$Q_1 > Q_2$
D.	opposite	$Q_1 < Q_2$

60 – (PHYSI/12_SL_Summer_2022_Q20) – *Electricity & Magnetism*

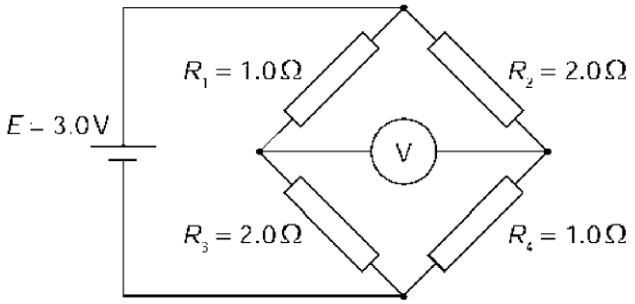
A battery of negligible internal resistance is connected to a lamp. A second identical lamp is added in series. What is the change in potential difference across the first lamp and what is the change in the output power of the battery?

	Change in potential difference	Output power of battery
A.	decreases	decreases
B.	decreases	increases
C.	no change	decreases
D.	no change	increases

61 – (PHYSI/12_SL_Summer_2022_Q21) – *Electricity & Magnetism*

A circuit consists of a cell of emf $E = 3.0\,V$ and four resistors connected as shown. Resistors R_1 and R_4 are $1.0\,\Omega$ and resistors R_2 and R_3 are $2.0\,\Omega$.

What is the voltmeter reading?



A. 0.50 V

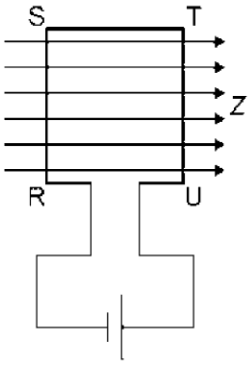
B. 1.0 V

C. 1.5 V

D. 2.0 V

62 – (PHYSI/12_SL_Summer_2022_Q22) – *Electricity & Magnetism*

A rectangular coil of wire RSTU is connected to a battery and placed in a magnetic field *Z* directed to the right. Both the plane of the coil and the magnetic field direction are in the same plane.



What is true about the magnetic force acting on the sides RS and ST?

	Force acting on RS	Force acting on ST
A.	into the page	into the page
B.	out of the page	no force acts
C.	into the page	no force acts
D.	out of the page	out of the page

63 – (PHYSI/10_SL_Winter_2022_Q16) – *Electricity & Magnetism*

Wire X and wire Y are connected in series in a circuit. Wire X has three times the radius and one third the charge carrier density of wire Y.

What is $\frac{\text{drift speed in X}}{\text{drift speed in Y}}$?

A. $\frac{1}{9}$

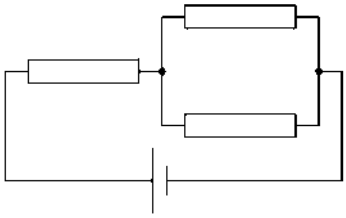
B. $\frac{1}{3}$

C. 1

D. 3

64 – (PHYSI/10_SL_Winter_2022_Q17) – *Electricity & Magnetism*

A cell of negligible internal resistance is connected to three identical resistors. The current in the cell is 3.0A.



The resistors are now arranged in series.

What is the new current in the cell?

A. 1.0A

B. 1.5A

C. 3.0A

D. 9.0A

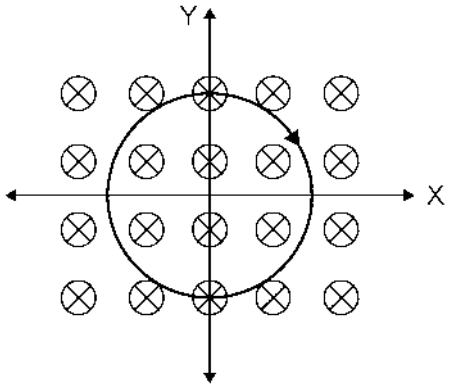
65 – (PHYSI/10_SL_Winter_2022_Q18) – *Electricity & Magnetism*

What is correct about the energy changes and the terminal potential difference during the discharge of a practical electrical cell?

	Energy changes	Terminal potential difference
A.	Chemical energy is transferred to electrical energy	Decreases uniformly over the cell lifetime
B.	Chemical energy is transferred to electrical energy	Decreases significantly at the end of the cell lifetime
C.	Electrical energy is transferred to chemical energy	Decreases uniformly over the cell lifetime
D.	Electrical energy is transferred to chemical energy	Decreases significantly at the end of the cell lifetime

66 – (PHYSI/10_SL_Winter_2022_Q19) – *Electricity & Magnetism*

A loop of wire lies in a magnetic field directed into the plane of the page. The loop carries a current in a clockwise direction.



The magnetic force acting on the wire tends to

A. rotate the loop about the X axis.

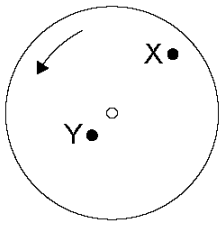
B. rotate the loop about the Y axis.

C. reduce the radius of the loop.

D. increase the radius of the loop.

1 – (PHYSI/11_SL_Summer_2017_Q22) – *Circular Motion & Gravitation*

A horizontal disc rotates uniformly at a constant angular velocity about a central axis normal to the plane of the disc.



Point X is a distance 2*L* from the centre of the disc. Point Y is a distance *L* from the centre of the disc. Point Y has a linear speed *v* and a centripetal acceleration *a*.

What is the linear speed and centripetal acceleration of point X?

	Linear speed of X	Centripetal acceleration of X
A.	*v*	*a*
B.	2v	2*a*
C.	*v*	2*a*
D.	2v	4*a*

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2 – (PHYSI/11_SL_Summer_2017_Q23) – *Circular Motion & Gravitation*

An object of constant mass is tied to the end of a rope of length l and made to move in a horizontal circle. The speed of the object is increased until the rope breaks at speed *v*. The length of the rope is then changed. At what other combination of rope length and speed will the rope break?

	Rope length	Speed
A.	$4l$	$2v$
B.	$2l$	v
C.	$2l$	$\frac{v}{2}$
D.	$4l$	$\frac{v}{2}$

3 – (PHYSI/12_SL_Summer_2017_Q22) – *Circular Motion & Gravitation*

Two satellites of mass m and $2m$ orbit a planet at the same orbit radius. If F is the force exerted on the satellite of mass m by the planet and a is the centripetal acceleration of this satellite, what is the force and acceleration of the satellite with mass $2m$?

	Force	Acceleration
A.	$2F$	a
B.	$2F$	$\frac{a}{2}$
C.	F	a
D.	F	$\frac{a}{2}$

4 – (PHYSI/12_SL_Summer_2017_Q23) – *Circular Motion & Gravitation*

The gravitational field strength at the surface of Earth is g. Another planet has double the radius of Earth and the same density as Earth. What is the gravitational field strength at the surface of this planet?

A. $\frac{g}{2}$

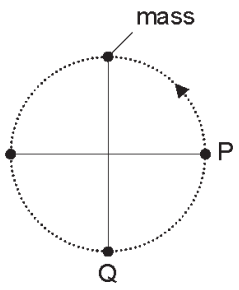
B. $\frac{g}{4}$

C. $2g$

D. $4g$

5 – (PHYSI/10_SL_Winter_2017_Q21) – *Circular Motion & Gravitation*

A mass attached to a string rotates in a gravitational field with a constant period in a vertical plane.



How do the tension in the string and the kinetic energy of the mass compare at P and Q?

	Tension in the string	Kinetic energy of mass
A.	greater at P than Q	greater at Q than P
B.	greater at Q than P	greater at Q than P
C.	greater at P than Q	same at Q and P
D.	greater at Q than P	same at Q and P

6 – (PHYSI/10_SL_Winter_2017_Q22) – *Circular Motion & Gravitation*

A satellite X of mass m orbits the Earth with a period T. What will be the orbital period of satellite Y of mass $2m$ occupying the same orbit as X?

A. $\frac{T}{2}$

B. T

C. $\sqrt{2}T$

D. $2T$

7 – (PHYSI/11_SL_Summer_2018_Q22) – *Circular Motion & Gravitation*

An object of mass m at the end of a string of length r moves in a vertical circle at a constant angular speed ω.

What is the tension in the string when the object is at the bottom of the circle?

A. $m(\omega^2 r + g)$

B. $m(\omega^2 r - g)$

C. $mg(\omega^2 r + 1)$

D. $mg(\omega^2 r - 1)$

8 – (PHYSI/11_SL_Summer_2018_Q23) – *Circular Motion & Gravitation*

Newton's law of gravitation

A. is equivalent to Newton's second law of motion.

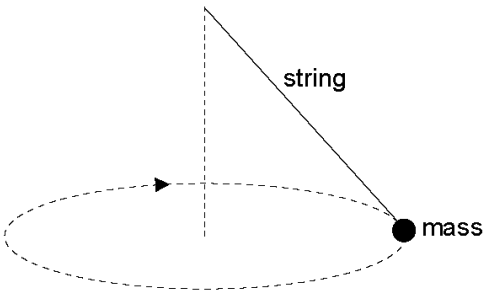
B. explains the origin of gravitation.

C. is used to make predictions.

D. is not valid in a vacuum.

9 – (PHYSI/12_SL_Summer_2018_Q23) – *Circular Motion & Gravitation*

A mass at the end of a string is swung in a horizontal circle at increasing speed until the string breaks.



The subsequent path taken by the mass is a

A. line along a radius of the circle.

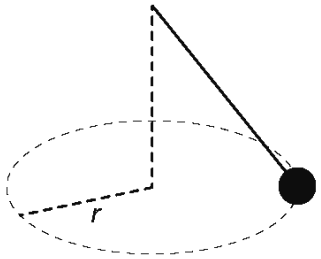
B. horizontal circle.

C. curve in a horizontal plane.

D. curve in a vertical plane.

10 – (PHYSI/10_SL_Winter_2018_Q7) – *Circular Motion & Gravitation*

The mass at the end of a pendulum is made to move in a horizontal circle of radius *r* at constant speed. The magnitude of the net force on the mass is *F*.



What is the direction of *F* and the work done by *F* during half a revolution?

	Direction of *F*	Work done by *F*
A.	towards centre of circle	zero
B.	towards centre of circle	πrF
C.	away from centre of circle	zero
D.	away from centre of circle	πrF

11 – (PHYSI/10_SL_Winter_2018_Q13) – *Circular Motion & Gravitation*

A particle moving in a circle completes 5 revolutions in 3 s. What is the frequency?

A. $\frac{3}{5}$ Hz

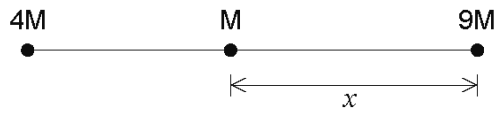
B. $\frac{5}{3}$ Hz

C. $\frac{3\pi}{5}$ Hz

D. $\frac{5\pi}{3}$ Hz

12 – (PHYSI/10_SL_Winter_2018_Q23) – *Circular Motion & Gravitation*

Two isolated point particles of mass 4M and 9M are separated by a distance 1 m. A point particle of mass M is placed a distance x from the particle of mass 9M. The net gravitational force on M is zero.



not to scale

What is x?

A. $\frac{4}{13}$m

B. $\frac{2}{5}$m

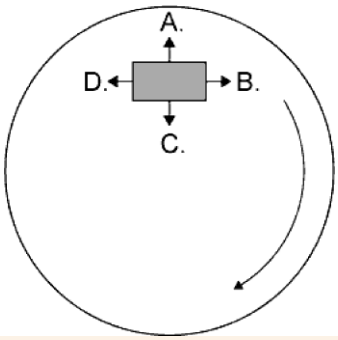
C. $\frac{3}{5}$m

D. $\frac{9}{13}$m

13 – (PHYSI/11_SL_Summer_2019_Q9) – *Circular Motion & Gravitation*

A block is on the surface of a horizontal rotating disk. The block is at rest relative to the disk. The disk is rotating at constant angular velocity.

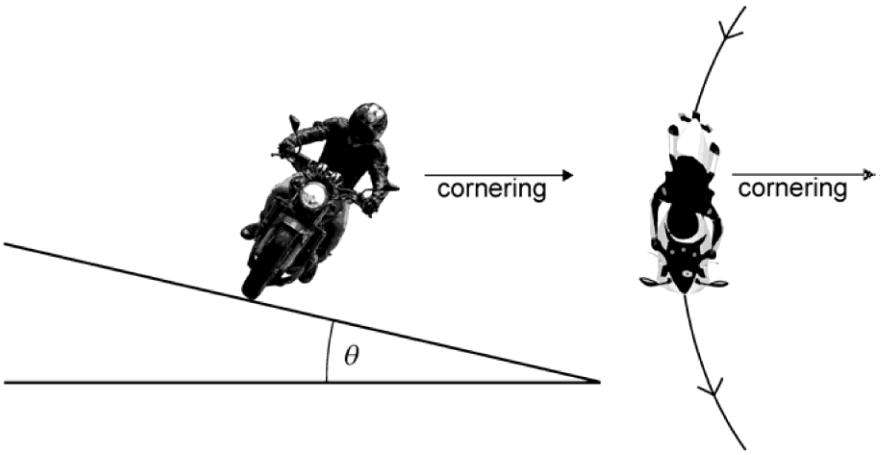
What is the correct arrow to represent the direction of the frictional force acting on the block at the instant shown?



14 – (PHYSI/11_SL_Summer_2019_Q24) – *Circular Motion & Gravitation*

A motorcyclist is cornering on a curved race track.

Which combination of changes of banking angle θ and coefficient of friction μ between the tyres and road allows the motorcyclist to travel around the corner at greater speed?



	Banking angle θ	Coefficient of friction μ
A.	increase	increase
B.	increase	decrease
C.	decrease	increase
D.	decrease	decrease

15 – (PHYSI/11_SL_Summer_2019_Q25) – *Circular Motion & Gravitation*

Satellite X orbits a planet with orbital radius R. Satellite Y orbits the same planet with orbital radius $2R$. Satellites X and Y have the same mass.

What is the ratio $\frac{\text{centripetal acceleration of X}}{\text{centripetal acceleration of Y}}$?

A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. 2

D. 4

16 – (PHYSI/12_SL_Summer_2019_Q22) – *Circular Motion & Gravitation*

A particle of mass 0.02 kg moves in a horizontal circle of diameter 1 m with an angular velocity of $3\pi\,\text{rad}\,\text{s}^{-1}$.

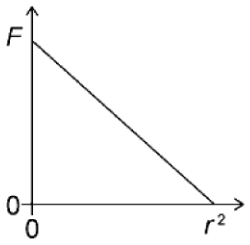
What is the magnitude and direction of the force responsible for this motion?

	Magnitude of force / N	Direction of force
A.	0.03π	away from centre of circle
B.	0.03π	towards centre of circle
C.	$0.09\pi^2$	away from centre of circle
D.	$0.09\pi^2$	towards centre of circle

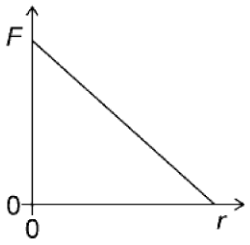
17 – (PHYSI/12_SL_Summer_2019_Q23) – *Circular Motion & Gravitation*

Which graph shows the relationship between gravitational force F between two point masses and their separation r?

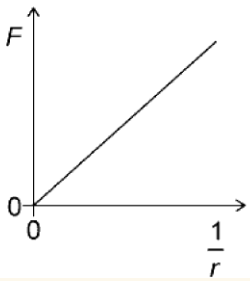
A.



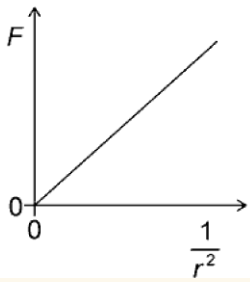
B.



C.

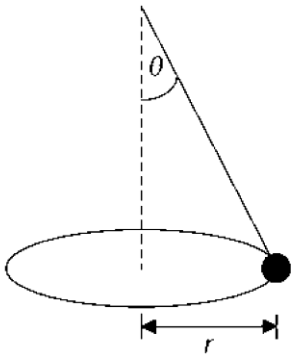


D.



18 – (PHYSI/10_SL_Winter_2019_Q21) – *Circular Motion & Gravitation*

An object hangs from a light string and moves in a horizontal circle of radius r.



The string makes an angle θ with the vertical. The angular speed of the object is ω. What is tan θ?

A. $\frac{\omega^2 r}{g}$

B. $\frac{g}{\omega^2 r}$

C. $\frac{\omega r^2}{g}$

D. $\frac{g}{\omega r^2}$

19 – (PHYSI/10_SL_Winter_2019_Q22) – *Circular Motion & Gravitation*

An object of mass m makes n revolutions per second around a circle of radius r at a constant speed. What is the kinetic energy of the object?

A. 0

B. $\frac{1}{2}\pi^2 mn^2 r^2$

C. $2\pi^2 mn^2 r^2$

D. $4\pi^2 mn^2 r^2$

20 – (PHYSI/10_SL_Winter_2019_Q23) – *Circular Motion & Gravitation*

A satellite travels around the Earth in a circular orbit. What is true about the forces acting in this situation?

A. The resultant force is the same direction as the satellite's acceleration.

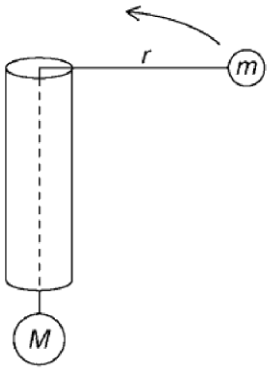
B. The gravitational force acting on the satellite is negligible.

C. There is no resultant force on the satellite relative to the Earth.

D. The satellite does not exert any force on the Earth.

21 – (PHYSI/10_SL_Winter_2020_Q22) – *Circular Motion & Gravitation*

Mass *M* is attached to one end of a string. The string is passed through a hollow tube and mass *m* is attached to the other end. Friction between the tube and string is negligible.



Mass *m* travels at constant speed *v* in a horizontal circle of radius *r*. What is mass *M*?

A. $\frac{mv^2}{r}$

B. mv^2rg

C. $\frac{mgv^2}{r}$

D. $\frac{mv^2}{gr}$

22 – (PHYSI/10_SL_Winter_2020_Q23) – *Circular Motion & Gravitation*

Planet X has a gravitational field strength of $18\,N\,kg^{-1}$ at its surface. Planet Y has the same density as X but three times the radius of X. What is the gravitational field strength at the surface of Y?

A. $6\,m\,s^{-2}$

B. $18\,m\,s^{-2}$

C. $54\,m\,s^{-2}$

D. $162\,m\,s^{-2}$

23 – (PHYSI/11_SL_Summer_2021_Q22) – *Circular Motion & Gravitation*

A child stands on a horizontal rotating platform that is moving at constant angular speed. The centripetal force on the child is provided by

A. the gravitational force on the child.

B. the friction on the child's feet.

C. the tension in the child's muscles.

D. the normal reaction of the platform on the child.

24 – (PHYSI/11_SL_Summer_2021_Q23) – *Circular Motion & Gravitation*

Which is the definition of gravitational field strength at a point?

A. The sum of the gravitational fields created by all masses around the point

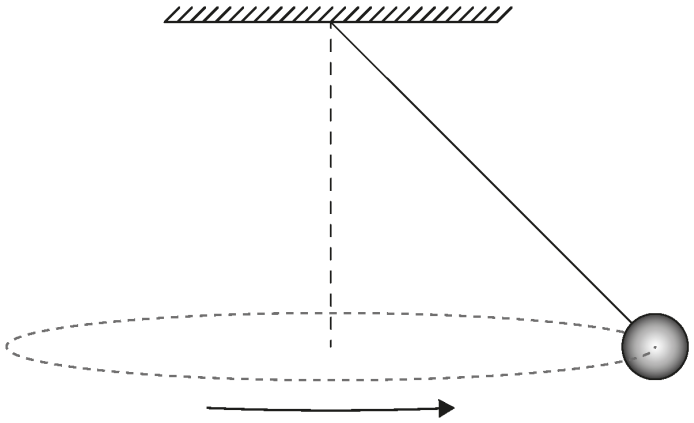
B. The gravitational force per unit mass experienced by a small point mass at that point

C. $G\frac{M}{r^2}$, where M is the mass of a planet and r is the distance from the planet to the point

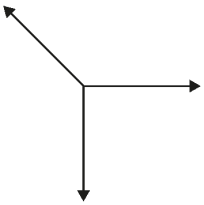
D. The resultant force of gravitational attraction on a mass at that point

25 – (PHYSI/12_SL_Summer_2021_Q24) – *Circular Motion & Gravitation*

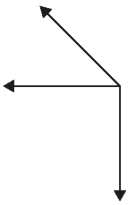
A sphere is suspended from the end of a string and rotates in a horizontal circle. Which free-body diagram, to the correct scale, shows the forces acting on the sphere?



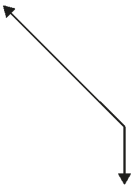
A.



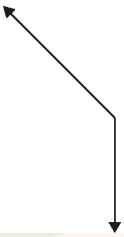
B.



C.

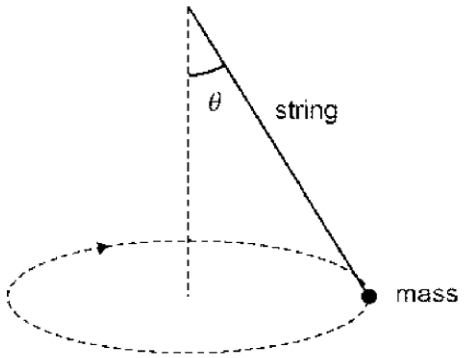


D.



26 – (PHYSI/10_SL_Winter_2021_Q22) – *Circular Motion & Gravitation*

A mass at the end of a string is moving in a horizontal circle at constant speed. The string makes an angle θ to the vertical.



What is the magnitude of the acceleration of the mass?

A. g

B. $g\sin\theta$

C. $g\cos\theta$

D. $g\tan\theta$

27 – (PHYSI/10_SL_Winter_2021_Q23) – *Circular Motion & Gravitation*

The gravitational field strength at the surface of a planet of radius R is g. A satellite is moving in a circular orbit a distance R above the surface of the planet. What is the magnitude of the acceleration of the satellite?

A. 0

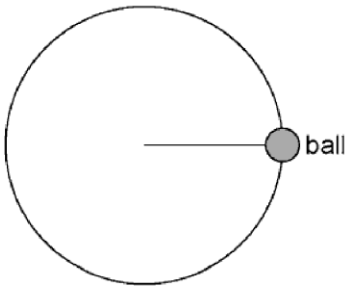
B. $\frac{g}{4}$

C. $\frac{g}{2}$

D. g

28 – (PHYSI/11_SL_Summer_2022_Q23) – *Circular Motion & Gravitation*

A ball of mass 0.3 kg is attached to a light, inextensible string. It is rotated in a vertical circle. The length of the string is 0.6 m and the speed of rotation of the ball is 4 m s^{-1}.



What is the tension when the string is horizontal?

A. 5 N

B. 8 N

C. 11 N

D. 13 N

29 – (PHYSI/12_SL_Summer_2022_Q23) – *Circular Motion & Gravitation*

A satellite is orbiting Earth in a circular path at constant speed. Three statements about the resultant force on the satellite are:

I. It is equal to the gravitational force of attraction on the satellite.

II. It is equal to the mass of the satellite multiplied by its acceleration.

III. It is equal to the centripetal force on the satellite.

Which combination of statements is correct?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

30 – (PHYSI/12_SL_Summer_2022_Q24) – *Circular Motion & Gravitation*

Three statements about Newton's law of gravitation are:

I. It can be used to predict the motion of a satellite.

II. It explains why gravity exists.

III. It is used to derive the expression for gravitational potential energy.

Which combination of statements is correct?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

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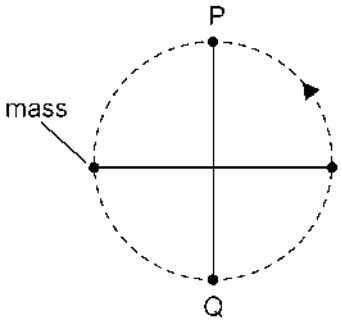
31 – (PHYSI/10_SL_Winter_2022_Q20) – *Circular Motion & Gravitation*

A car on a road follows a horizontal circular path at a constant speed. What is the direction of the net force acting on the car and the direction of the instantaneous velocity of the car?

	Direction of net force	Direction of instantaneous velocity
A.	Away from centre of the circle	Tangent to the circle
B.	Away from centre of the circle	Toward centre of the circle
C.	Toward centre of the circle	Tangent to the circle
D.	Toward centre of the circle	Toward centre of the circle

32 – (PHYSI/10_SL_Winter_2022_Q21) – *Circular Motion & Gravitation*

A mass attached to a string rotates in a gravitational field with a constant period in a vertical plane.

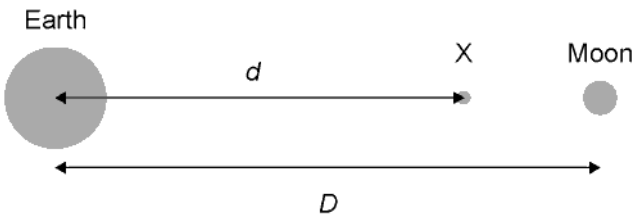


How do the speed of the mass and the tension of the string compare at P and Q?

	Speed of the mass	Tension in the string
A.	Equal	Equal
B.	Equal	Greater at Q
C.	Greater at Q	Equal
D.	Greater at Q	Greater at Q

33 – (PHYSI/10_SL_Winter_2022_Q22) – *Circular Motion & Gravitation*

The centre of the Earth and the Moon are a distance D apart. There is a point X between them where their gravitational fields cancel out. The distance from the centre of the Earth to X is d. The mass of the Earth is M_E and the mass of the Moon is M_M.



What is correct at X?

A. $\frac{M_E}{d} = \frac{M_M}{D-d}$

B. $\frac{M_E}{D-d} = \frac{M_M}{d}$

C. $\frac{M_E}{d^2} = \frac{M_M}{(D-d)^2}$

D. $\frac{M_E}{d^2} = \frac{M_M}{D^2-d^2}$

1 – (PHYSI/11_SL_Summer_2017_Q24) – *Atomic,nuclear & Particle Physics*

A nucleus of phosphorus (P) decays to a nucleus of silicon (Si) with the emission of particle X and particle Y.

$$^{30}_{15}P \rightarrow {}^{30}_{14}Si + X + Y$$

What are X and Y?

	X	Y
A.	antineutrino	positron
B.	antineutrino	electron
C.	neutrino	electron
D.	neutrino	positron

2 – (PHYSI/11_SL_Summer_2017_Q25) – *Atomic,nuclear & Particle Physics*

What is the definition of the unified atomic mass unit?

A. $\frac{1}{12}$ the mass of a neutral atom of carbon-12

B. The mass of a neutral atom of hydrogen-1

C. $\frac{1}{12}$ the mass of a nucleus of carbon-12

D. The mass of a nucleus of hydrogen-1

3 – (PHYSI/11_SL_Summer_2017_Q26) – *Atomic,nuclear & Particle Physics*

In nuclear fission, a nucleus of element X absorbs a neutron (n) to give a nucleus of element Y and a nucleus of element Z.

$$X + n \rightarrow Y + Z + 2n$$

What is $\frac{\text{magnitude of the binding energy per nucleon of Y}}{\text{magnitude of the binding energy per nucleon of X}}$ and $\frac{\text{total binding energy of Y and Z}}{\text{total binding energy of X}}$?

	$\frac{\text{Magnitude of the binding energy per nucleon of Y}}{\text{Magnitude of the binding energy per nucleon of X}}$	$\frac{\text{Total binding energy of Y and Z}}{\text{Total binding energy of X}}$
A.	greater than 1	greater than 1
B.	less than 1	greater than 1
C.	greater than 1	less than 1
D.	less than1	less than 1

4 – (PHYSI/11_SL_Summer_2017_Q27) – *Atomic,nuclear & Particle Physics*

What is the energy equivalent to the mass of one proton?

A. $9.38 \times (3 \times 10^8)^2 \times 10^6\,\text{J}$

B. $9.38 \times (3 \times 10^8)^2 \times 1.6 \times 10^{-19}\,\text{J}$

C. $\frac{9.38 \times 10^8}{1.6 \times 10^{-19}}\,\text{J}$

D. $9.38 \times 10^8 \times 1.6 \times 10^{-19}\,\text{J}$

5 – (PHYSI/12_SL_Summer_2017_Q24) – *Atomic,nuclear & Particle Physics*

Atomic spectra are caused when a certain particle makes transitions between energy levels. What is this particle?

A. Electron

B. Proton

C. Neutron

D. Alpha particle

6 – (PHYSI/12_SL_Summer_2017_Q25) – *Atomic,nuclear & Particle Physics*

The half-life of a radioactive element is 5.0 days. A freshly-prepared sample contains 128 g of this element. After how many days will there be 16 g of this element left behind in the sample?

A. 5.0 days

B. 10 days

C. 15 days

D. 20 days

7 – (PHYSI/12_SL_Summer_2017_Q26) – *Atomic,nuclear & Particle Physics*

The binding energy per nucleon of $^{11}_{4}Be$ is 6 MeV. What is the energy required to separate the nucleons of this nucleus?

A. 24 MeV

B. 42 MeV

C. 66 MeV

D. 90 MeV

8 – (PHYSI/12_SL_Summer_2017_Q27) – *Atomic,nuclear & Particle Physics*

The reaction $p^+ + n^0 \rightarrow p^+ + \pi^0$ does **not** occur because it violates the conservation law of

A. electric charge.

B. baryon number.

C. lepton number.

D. strangeness.

9 – (PHYSI/10_SL_Winter_2017_Q23) – *Atomic,nuclear & Particle Physics*

Which statement about atomic spectra is **not** true?

A. They provide evidence for discrete energy levels in atoms.

B. Emission and absorption lines of equal frequency correspond to transitions between the same two energy levels.

C. Absorption lines arise when electrons gain energy.

D. Emission lines always correspond to the visible part of the electromagnetic spectrum.

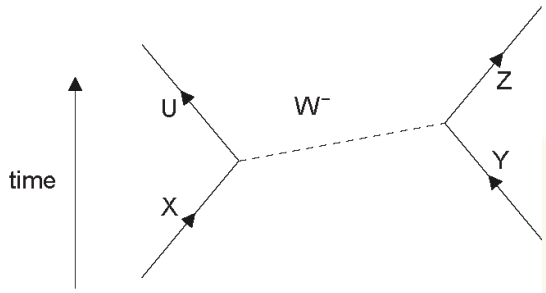
10 – (PHYSI/10_SL_Winter_2017_Q24) – *Atomic,nuclear & Particle Physics*

What gives the total change in nuclear mass and the change in nuclear binding energy as a result of a nuclear fusion reaction?

	Nuclear mass	Nuclear binding energy
A.	decreases	decreases
B.	decreases	increases
C.	increases	decreases
D.	increases	increases

11 – (PHYSI/10_SL_Winter_2017_Q25) – *Atomic,nuclear & Particle Physics*

The Feynman diagram shows a particle interaction involving a W^- boson.



Which particles are interacting?

A. U and Y

B. W^- boson and Y

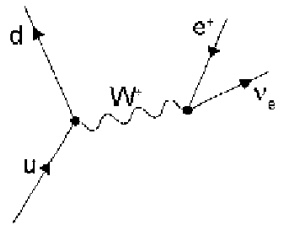
C. X and Y

D. U and X

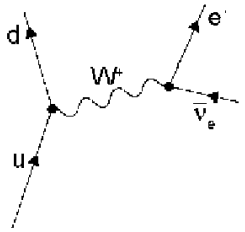
12 – (PHYSI/11_SL_Summer_2018_Q24) – *Atomic,nuclear & Particle Physics*

Which Feynman diagram shows beta-plus (β^+) decay?

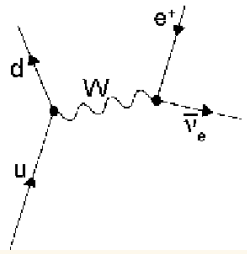
A.



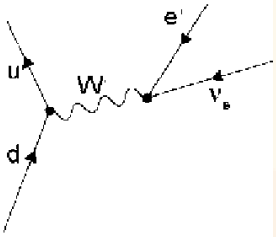
B.



C.



D.



13 – (PHYSI/11_SL_Summer_2018_Q25) – *Atomic,nuclear & Particle Physics*

The average binding energy per nucleon of the $^{15}_{8}O$ nucleus is 7.5 MeV. What is the total energy required to separate the nucleons of one nucleus of $^{15}_{8}O$?

A. 53 MeV

B. 60 MeV

C. 113 MeV

D. 173 MeV

14 – (PHYSI/11_SL_Summer_2018_Q26) – *Atomic,nuclear & Particle Physics*

Two pure samples of radioactive nuclides X and Y have the same initial number of atoms. The half-life of X is $T_{\frac{1}{2}}$.

After a time equal to 4 half-lives of X the ratio $\frac{\text{number of atoms of X}}{\text{number of atoms of Y}}$ is $\frac{1}{8}$.

What is the half-life of Y?

A. $0.25T_{\frac{1}{2}}$

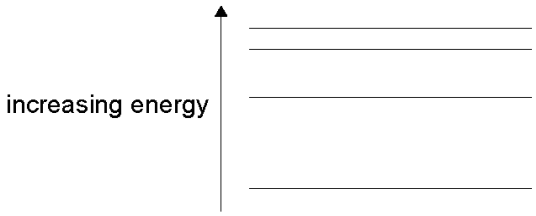
B. $0.5T_{\frac{1}{2}}$

C. $3T_{\frac{1}{2}}$

D. $4T_{\frac{1}{2}}$

15 – (PHYSI/11_SL_Summer_2018_Q27) – *Atomic,nuclear & Particle Physics*

The energy-level diagram for an atom that has four energy states is shown.



What is the number of different wavelengths in the emission spectrum of this atom?

A. 1

B. 3

C. 6

D. 7

16 – (PHYSI/12_SL_Summer_2018_Q24) – *Atomic,nuclear & Particle Physics*

A detector, placed close to a radioactive source, detects an activity of 260 Bq. The average background activity at this location is 20 Bq. The radioactive nuclide has a half-life of 9 hours. What activity is detected after 36 hours?

A. 15 Bq

B. 16 Bq

C. 20 Bq

D. 35 Bq

17 – (PHYSI/12_SL_Summer_2018_Q25) – *Atomic,nuclear & Particle Physics*

Element X decays through a series of alpha (α) and beta minus (β^-) emissions. Which series of emissions results in an isotope of X?

A. 1α and $2\beta^-$

B. 1α and $4\beta^-$

C. 2α and $2\beta^-$

D. 2α and $3\beta^-$

18 – (PHYSI/12_SL_Summer_2018_Q26) – *Atomic,nuclear & Particle Physics*

A graph of the variation of average binding energy per nucleon with nucleon number has a maximum. What is indicated by the region around the maximum?

A. The position below which radioactive decay cannot occur

B. The region in which fission is most likely to occur

C. The position where the most stable nuclides are found

D. The region in which fusion is most likely to occur

19 – (PHYSI/12_SL_Summer_2018_Q27) – *Atomic,nuclear & Particle Physics*

Three of the fundamental forces between particles are

I. strong nuclear
II. weak nuclear
III. electromagnetic.

What forces are experienced by an electron?

A. I and II only

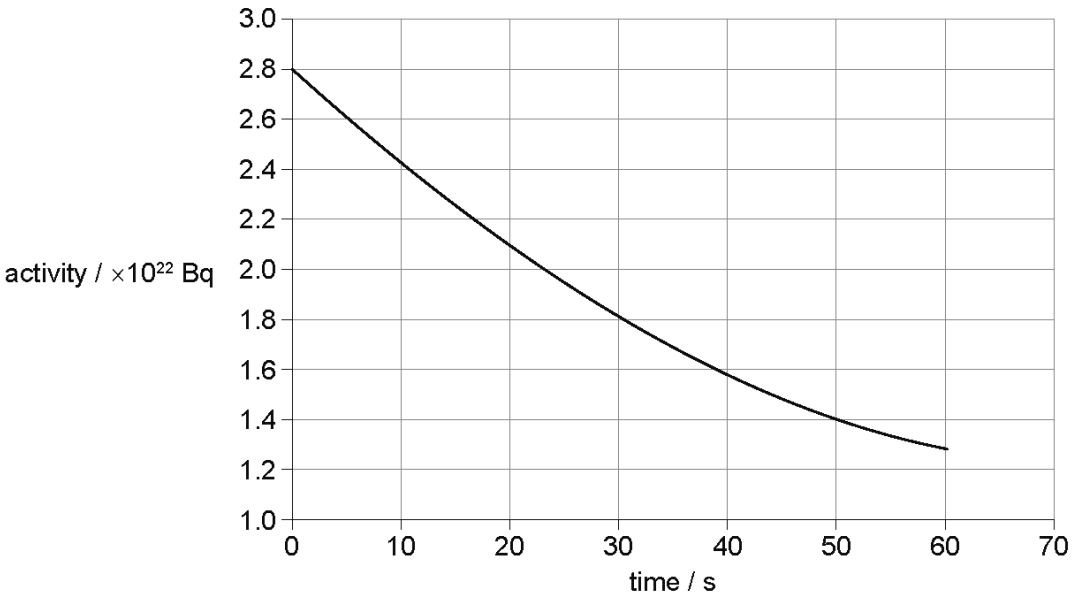
B. I and III only

C. II and III only

D. I, II and III

20 – (PHYSI/10_SL_Winter_2018_Q24) – *Atomic,nuclear & Particle Physics*

The graph shows the variation with time of the activity of a pure sample of a radioactive nuclide.
What percentage of the nuclide remains after 200 s?



A. 3.1 %

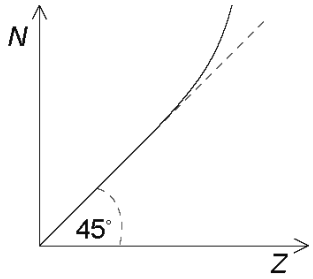
B. 6.3 %

C. 13 %

D. 25 %

21 – (PHYSI/10_SL_Winter_2018_Q25) – *Atomic,nuclear & Particle Physics*

The graph shows the variation of the number of neutrons N with the atomic number Z for stable nuclei. The same scale is used in the N and Z axes.



Which information can be inferred from the graph?

I. For stable nuclei with high Z, N is larger than Z.

II. For stable nuclei with small Z, $N = Z$.

III. All stable nuclei have more neutrons than protons.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

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22 – (PHYSI/10_SL_Winter_2018_Q26) – *Atomic,nuclear & Particle Physics*

Copper $\left({}^{64}_{29}\text{Cu}\right)$ decays to nickel $\left({}^{64}_{28}\text{Ni}\right)$. What are the particles emitted and the particle that mediates the interaction?

	Particles emitted	Mediating particle
A.	β^- and neutrino	W^+
B.	β^+ and neutrino	W^-
C.	β^- and neutrino	W^-
D.	β^+ and neutrino	W^+

23 – (PHYSI/10_SL_Winter_2018_Q27) – *Atomic,nuclear & Particle Physics*

The following interaction is proposed between a proton and a pion.

$$p^+ + \pi^- \rightarrow K^- + \pi^+$$

The quark content of the π^- is $\bar{u}d$ and the quark content of the K^- is $\bar{u}s$.

Three conservation rules are considered

I. baryon number
II. charge
III. strangeness.

Which conservation rules are violated in this interaction?

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

24 – (PHYSI/10_SL_Winter_2018_Q28) – *Atomic,nuclear & Particle Physics*

What is the function of control rods in a nuclear power plant?

A. To slow neutrons down
B. To regulate fuel supply
C. To exchange thermal energy
D. To regulate the reaction rate

25 – (PHYSI/11_SL_Summer_2019_Q26) – *Atomic,nuclear & Particle Physics*

Which property of a nuclide does **not** change as a result of beta decay?

A. Nucleon number
B. Neutron number
C. Proton number
D. Charge

26 – (PHYSI/11_SL_Summer_2019_Q27) – *Atomic,nuclear & Particle Physics*

The rest mass of the helium isotope $^{3}_{2}\text{He}$ is m.

Which expression gives the binding energy per nucleon for $^{3}_{2}\text{He}$?

A. $\frac{(2m_p + m_n + m)c^2}{3}$

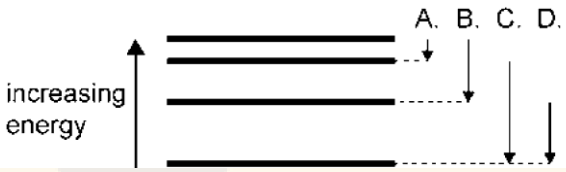
B. $\frac{(2m_p + m_n - m)c^2}{3}$

C. $(2m_p + m_n + m)c^2$

D. $(2m_p + m_n - m)c^2$

27 – (PHYSI/11_SL_Summer_2019_Q28) – *Atomic,nuclear & Particle Physics*

Which of the following atomic energy level transitions corresponds to photons of the shortest wavelength?



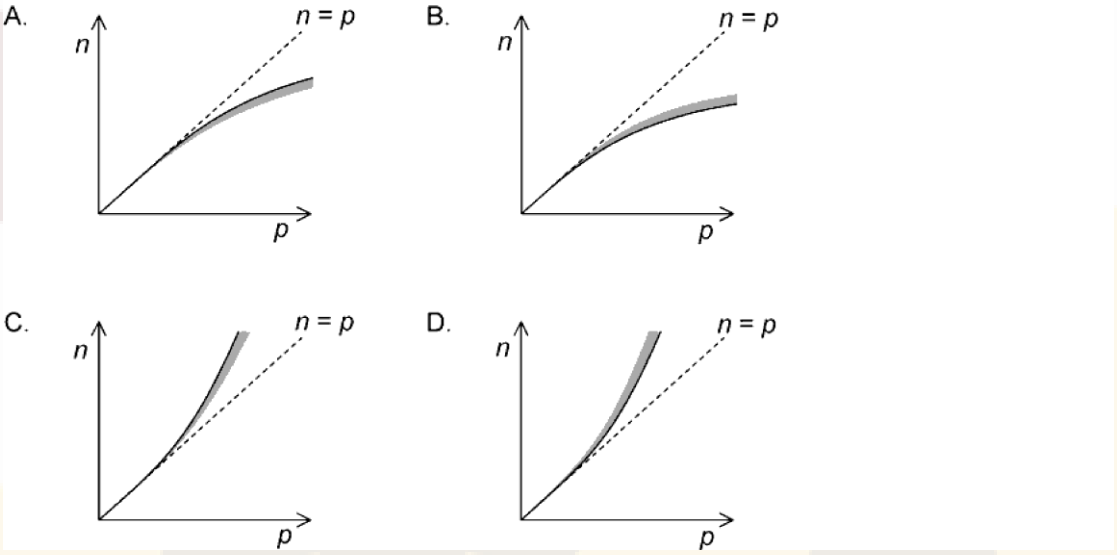
28 – (PHYSI/12_SL_Summer_2019_Q24) – *Atomic,nuclear & Particle Physics*

A radioactive nuclide with atomic number Z undergoes a process of beta-plus (β^+) decay. What is the atomic number for the nuclide produced and what is another particle emitted during the decay?

	Atomic number	Particle
A.	Z – 1	neutrino
B.	Z + 1	neutrino
C.	Z – 1	anti-neutrino
D.	Z + 1	anti-neutrino

29 – (PHYSI/12_SL_Summer_2019_Q25) – *Atomic,nuclear & Particle Physics*

The positions of stable nuclei are plotted by neutron number n and proton number p. The graph indicates a dotted line for which $n = p$. Which graph shows the line of stable nuclides and the shaded region where unstable nuclei emit beta minus (β^-) particles?



30 – (PHYSI/12_SL_Summer_2019_Q26) – *Atomic,nuclear & Particle Physics*

Three conservation laws in nuclear reactions are

I. conservation of charge
II. conservation of baryon number
III. conservation of lepton number.

The reaction

$$n \rightarrow \pi^- + e^- + \bar{\nu}_e$$

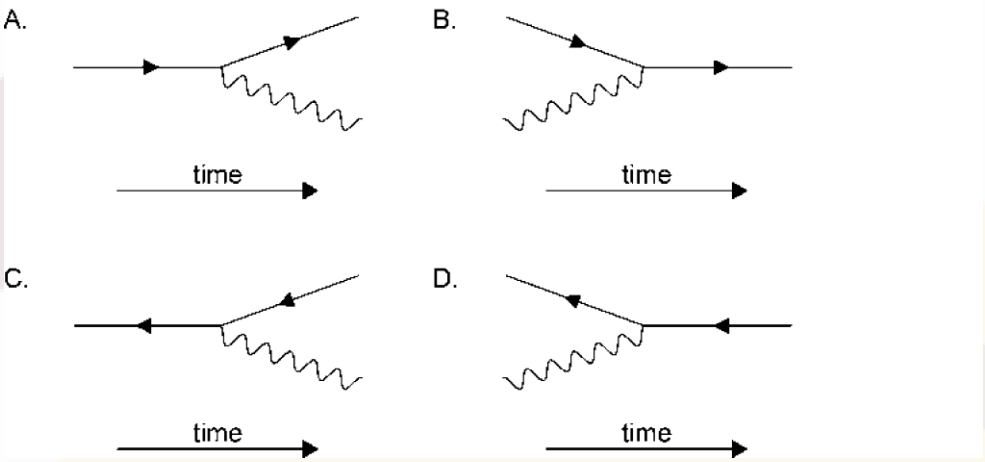
is proposed.

Which conservation laws are violated in the proposed reaction?

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

31 – (PHYSI/12_SL_Summer_2019_Q27) – *Atomic,nuclear & Particle Physics*

Which Feynman diagram shows the emission of a photon by a charged antiparticle?



32 – (PHYSI/12_SL_Summer_2019_Q28) – *Atomic,nuclear & Particle Physics*

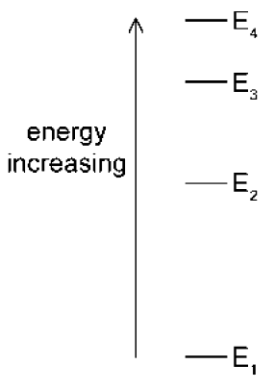
A neutron collides head-on with a stationary atom in the moderator of a nuclear power station. The kinetic energy of the neutron changes as a result. There is also a change in the probability that this neutron can cause nuclear fission.

What are these changes?

	Change in kinetic energy of the neutron	Change in probability of causing nuclear fission
A.	increase	increase
B.	decrease	increase
C.	increase	decrease
D.	decrease	decrease

33 – (PHYSI/10_SL_Winter_2019_Q24) – *Atomic,nuclear & Particle Physics*

The energy levels for an atom are shown to scale.



A photon of wavelength λ is emitted because of a transition from E_3 to E_2. Which transition leads to the emission of a photon of longer wavelength?

A. E_4 to E_1

B. E_4 to E_3

C. E_3 to E_1

D. E_2 to E_1

34 – (PHYSI/10_SL_Winter_2019_Q25) – *Atomic,nuclear & Particle Physics*

A proton, an electron and an alpha particle are at rest. Which particle has the smallest magnitude of ratio of charge to mass and which particle has the largest magnitude of ratio of charge to mass?

	Smallest charge to mass ratio	Largest charge to mass ratio
A.	alpha	electron
B.	electron	alpha
C.	electron	proton
D.	proton	electron

35 – (PHYSI/10_SL_Winter_2019_Q26) – *Atomic,nuclear & Particle Physics*

X is a radioactive nuclide that decays to a stable nuclide. The activity of X falls to $\frac{1}{16}$th of its original value in 32 s.

What is the half-life of X?

A. 2 s

B. 4 s

C. 8 s

D. 16 s

36 – (PHYSI/10_SL_Winter_2019_Q27) – *Atomic,nuclear & Particle Physics*

What is correct about the nature and range of the strong interaction between nuclear particles?

A. It is attractive at all particle separations.

B. It is attractive for particle separations between 0.7 fm and 3 fm.

C. It is repulsive for particle separations greater than 3 fm.

D. It is repulsive at all particle separations.

37 – (PHYSI/10_SL_Winter_2020_Q24) – *Atomic,nuclear & Particle Physics*

What are the principal roles of a moderator and of a control rod in a thermal nuclear reactor?

	Role of moderator	Role of control rod
A.	increases kinetic energy of neutrons	maintains a constant rate of reaction
B.	increases kinetic energy of neutrons	absorbs energy transferred in the reactor
C.	reduces kinetic energy of neutrons	maintains a constant rate of reaction
D.	reduces kinetic energy of neutrons	absorbs energy transferred in the reactor

38 – (PHYSI/10_SL_Winter_2020_Q25) – *Atomic,nuclear & Particle Physics*

A nuclear power station contains an alternating current generator. What energy transfer is performed by the generator?

A. Electrical to kinetic

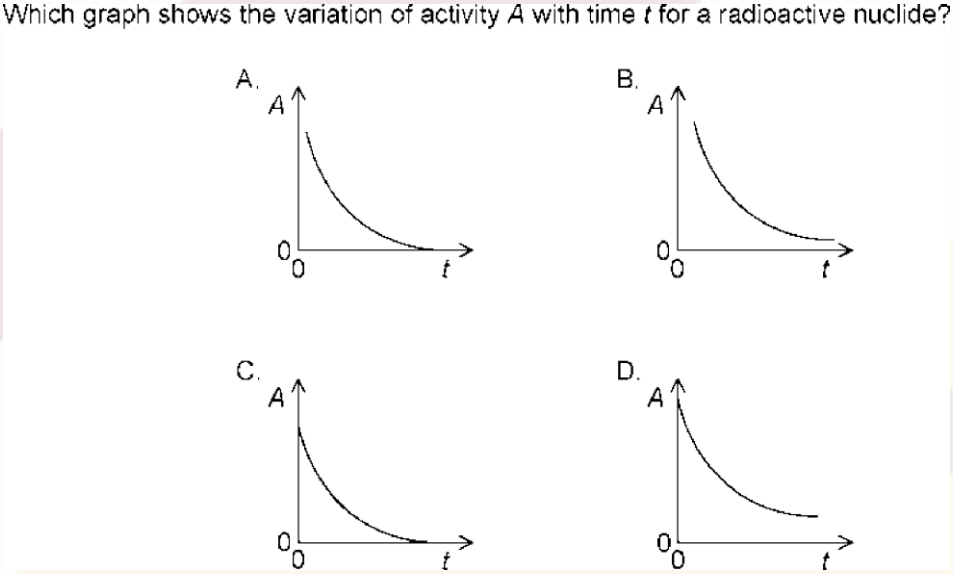
B. Kinetic to electrical

C. Nuclear to kinetic

D. Nuclear to electrical

39 – (PHYSI/10_SL_Winter_2020_Q27) – *Atomic,nuclear & Particle Physics*

Which graph shows the variation of activity A with time t for a radioactive nuclide?



40 – (PHYSI/10_SL_Winter_2020_Q28) – *Atomic,nuclear & Particle Physics*

What statement about alpha particles, beta particles and gamma radiation is true?

A. Gamma radiation always travels faster than beta particles in a vacuum.

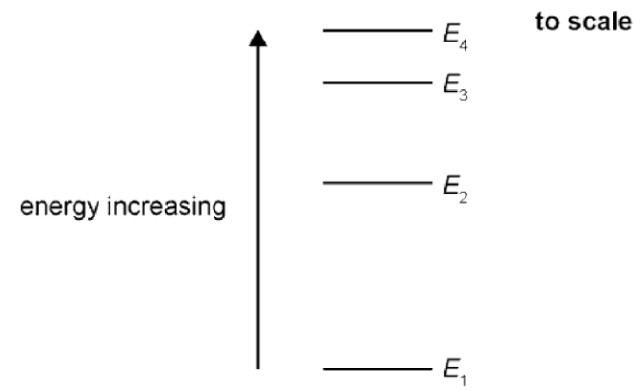
B. In air, beta particles produce more ions per unit length travelled than alpha particles.

C. Alpha particles are always emitted when beta particles are emitted.

D. Alpha particles are deflected in the same direction as beta particles in a magnetic field.

41 – (PHYSI/10_SL_Winter_2020_Q29) – *Atomic,nuclear & Particle Physics*

Four of the energy states for an atom are shown. Transition between any two states is possible.



What is the shortest wavelength of radiation that can be emitted from these four states?

A. $\frac{hc}{E_4 - E_1}$

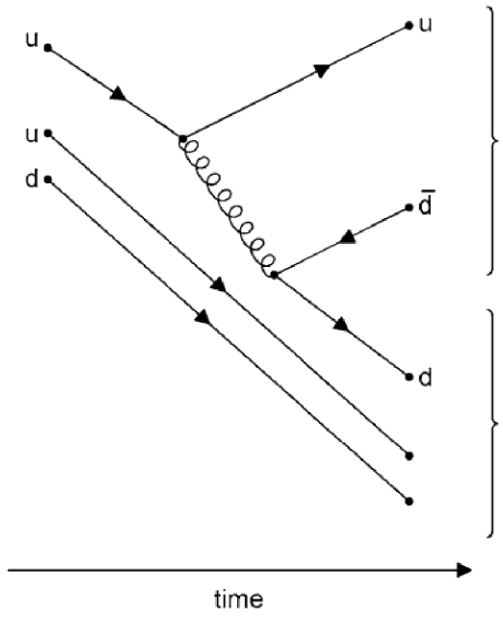
B. $\frac{hc}{E_4} - \frac{hc}{E_1}$

C. $\frac{hc}{E_4 - E_3}$

D. $\frac{hc}{E_4} - \frac{hc}{E_3}$

42 – (PHYSI/10_SL_Winter_2020_Q30) – *Atomic,nuclear & Particle Physics*

The Feynman diagram shows some of the changes in a proton–proton collision.



What is the equation for this collision?

A. $p + p \rightarrow p + n + \pi^+$

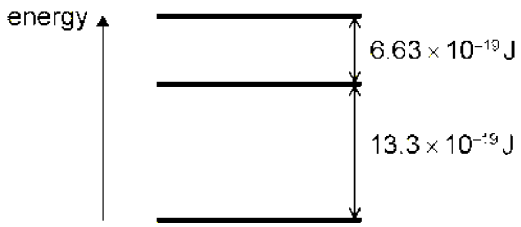
B. $p + p \rightarrow p + n + \pi$

C. $p + p \rightarrow p + \bar{n} + \pi^+$

D. $p + p \rightarrow p + \bar{n} + \pi^-$

43 – (PHYSI/11_SL_Summer_2021_Q24) – *Atomic,nuclear & Particle Physics*

A simple model of an atom has three energy levels. The differences between adjacent energy levels are shown below.



What are the two smallest frequencies in the emission spectrum of this atom?

A. 0.5×10^{15} Hz and 1.0×10^{15} Hz

B. 0.5×10^{15} Hz and 1.5×10^{15} Hz

C. 1.0×10^{15} Hz and 2.0×10^{15} Hz

D. 1.0×10^{15} Hz and 3.0×10^{15} Hz

44 – (PHYSI/11_SL_Summer_2021_Q25) – *Atomic,nuclear & Particle Physics*

What is the relation between the value of the unified atomic mass unit in grams and the value of Avogadro's constant in mol^{-1}?

A. Their ratio is 1.

B. Their product is 1.

C. Their sum is 1.

D. Their difference is 0.

45 – (PHYSI/11_SL_Summer_2021_Q26) – *Atomic,nuclear & Particle Physics*

Three particles are produced when the nuclide $^{23}_{12}\text{Mg}$ undergoes beta-plus (β^+) decay. What are two of these particles?

A. $^{23}_{11}\text{Na}$ and $^{0}_{0}\nu_e$

B. $^{0}_{1}\text{e}$ and $^{0}_{0}\nu_e$

C. $^{23}_{11}\text{Na}$ and $^{0}_{0}\bar{\nu}_e$

D. $^{0}_{1}\text{e}$ and $^{0}_{0}\bar{\nu}_e$

46 – (PHYSI/11_SL_Summer_2021_Q27) – *Atomic,nuclear & Particle Physics*

A particle reaction is

$$p + e + \bar{\nu}_{\mu} \rightarrow n + \mu^{-} + \nu_{e}.$$

Which conservation law is violated by the reaction?

A. Baryon number

B. Charge

C. Lepton number

D. Momentum

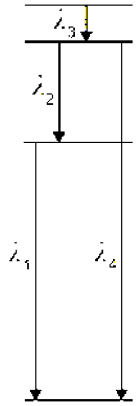
47 – (PHYSI/12_SL_Summer_2021_Q25) – *Atomic,nuclear & Particle Physics*

When a high-energy α-particle collides with a beryllium-9 ($^{9}_{4}$Be) nucleus, a nucleus of carbon ($Z = 6$) may be produced. What are the products of this reaction?

	Product 1	Product 2
A.	carbon-12	proton
B.	carbon-12	neutron
C.	carbon-14	proton
D.	carbon-14	neutron

48 – (PHYSI/12_SL_Summer_2021_Q26) – *Atomic,nuclear & Particle Physics*

The diagram below shows four energy levels for the atoms of a gas. The diagram is drawn to scale. The wavelengths of the photons emitted by the energy transitions between levels are shown.



What are the wavelengths of spectral lines, emitted by the gas, in order of decreasing frequency?

A. $\lambda_3, \lambda_2, \lambda_1, \lambda_4$

B. $\lambda_4, \lambda_1, \lambda_2, \lambda_3$

C. $\lambda_4, \lambda_3, \lambda_2, \lambda_1$

D. $\lambda_4, \lambda_2, \lambda_1, \lambda_3$

49 – (PHYSI/12_SL_Summer_2021_Q27) – *Atomic,nuclear & Particle Physics*

A kaon is made up of two quarks. What is the particle classification of a kaon?

A. Exchange boson

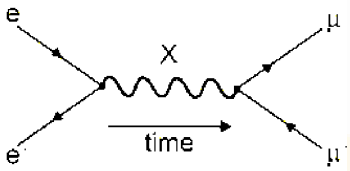
B. Baryon

C. Lepton

D. Meson

50 – (PHYSI/12_SL_Summer_2021_Q28) – *Atomic,nuclear & Particle Physics*

Consider the Feynman diagram below.



What is the exchange particle X?

A. Lepton

B. Gluon

C. Meson

D. Photon

51 – (PHYSI/10_SL_Winter_2021_Q24) – *Atomic,nuclear & Particle Physics*

A pure sample of radioactive nuclide X decays into a stable nuclide Y.

What is $\frac{\text{number of atoms of Y}}{\text{number of atoms of X}}$ after two half-lives?

A. 1

B. 2

C. 3

D. 4

52 – (PHYSI/10_SL_Winter_2021_Q25) – *Atomic,nuclear & Particle Physics*

The mass of a nucleus of iron-56 ($^{56}_{26}\text{Fe}$) is M.

What is the mass defect of the nucleus of iron-56?

A. $M - 26m_p - 56m_n$

B. $26m_p + 30m_n - M$

C. $M - 26m_p - 56m_n - 26m_e$

D. $26m_p + 30m_n + 26m_e - M$

53 – (PHYSI/10_SL_Winter_2021_Q26) – *Atomic,nuclear & Particle Physics*

A proton collides with an electron. What are the possible products of the collision?

A. Two neutrons

B. Neutron and positron

C. Neutron and antineutrino

D. Neutron and neutrino

54 – (PHYSI/10_SL_Winter_2021_Q27) – *Atomic,nuclear & Particle Physics*

The Higgs boson was discovered in the Large Hadron Collider at CERN. Which statements are correct about the discovery of the Higgs boson?

I. It was independent of previous theoretical work.

II. It involved analysing large amounts of experimental data.

III. It was consistent with the standard model of particle physics.

A. I and II only

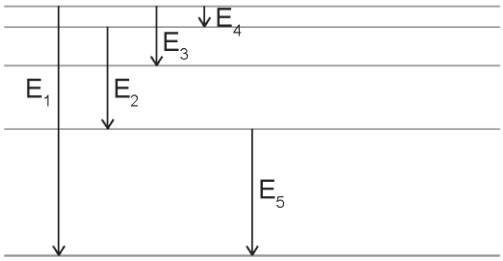
B. I and III only

C. II and III only

D. I, II and III

55 – (PHYSI/11_SL_Summer_2022_Q24) – *Atomic,nuclear & Particle Physics*

Some transitions between the energy states of a particular atom are shown.



Energy transition E_3 gives rise to a photon of green light. Which transition will give rise to a photon of longer wavelength?

A. E_1

B. E_2

C. E_4

D. E_5

56 – (PHYSI/11_SL_Summer_2022_Q25) – *Atomic,nuclear & Particle Physics*

Three statements about radioactive decay are:

I. The rate of decay is exponential.

II. It is unaffected by temperature and pressure.

III. The decay of individual nuclei cannot be predicted.

Which statements are correct?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

57 – (PHYSI/11_SL_Summer_2022_Q26) – *Atomic,nuclear & Particle Physics*

The background count in a laboratory is 20 counts per second. The initial observed count rate of a pure sample of nitrogen-13 in this laboratory is 180 counts per second. The half-life of nitrogen-13 is 10 minutes. What is the expected count rate of the sample after 30 minutes?

A. 20 counts per second

B. 23 counts per second

C. 40 counts per second

D. 60 counts per second

58 – (PHYSI/11_SL_Summer_2022_Q27) – *Atomic,nuclear & Particle Physics*

$^{238}_{92}U$ undergoes an alpha decay, followed by a beta-minus decay. What is the number of protons and neutrons in the resulting nuclide?

	Number of protons	Number of neutrons
A.	89	234
B.	91	144
C.	91	143
D.	89	145

59 – (PHYSI/12_SL_Summer_2022_Q25) – *Atomic,nuclear & Particle Physics*

Three statements about electrons are:

I. Electrons interact through virtual photons.

II. Electrons interact through gluons.

III. Electrons interact through particles W and Z.

Which statements identify the particles mediating the forces experienced by electrons?

A. I and II only

B. I and III only

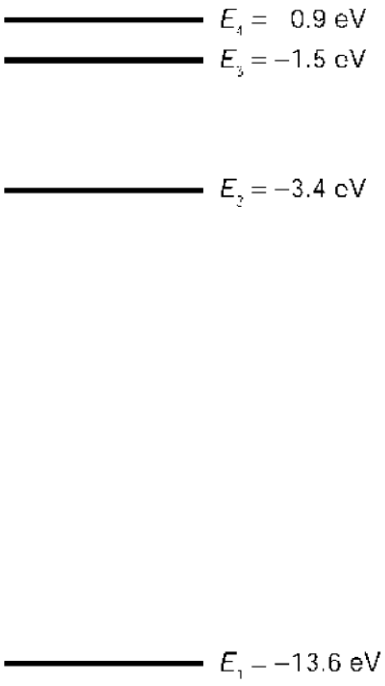
C. II and III only

D. I, II and III

60 – (PHYSI/12_SL_Summer_2022_Q26) – *Atomic,nuclear & Particle Physics*

The energy levels of an atom are shown. How many photons of energy **greater** than 1.9 eV can be emitted by this atom?

diagram not to scale



A. 1

B. 2

C. 3

D. 4

61 – (PHYSI/12_SL_Summer_2022_Q27) – *Atomic,nuclear & Particle Physics*

What statement is **not** true about radioactive decay?

A. The percentage of radioactive nuclei of an isotope in a sample of that isotope after 7 half-lives is smaller than 1 %.

B. The half-life of a radioactive isotope is the time taken for half the nuclei in a sample of that isotope to decay.

C. The whole-life of a radioactive isotope is the time taken for all the nuclei in a sample of that isotope to decay.

D. The half-life of radioactive isotopes range between extremely short intervals to thousands of millions of years.

62 – (PHYSI/10_SL_Winter_2022_Q23) – *Atomic,nuclear & Particle Physics*

A nucleus of krypton (Kr) decays to a nucleus of bromine (Br) according to the equation

$$^{84}_{36}\text{Kr} \rightarrow {}^{84}_{35}\text{Br} + \text{Y} + \text{Z}$$

What are Y and Z?

	Y	Z
A.	e^+	ν_e
B.	e^-	ν_e
C.	e^+	$\overline{\nu}_e$
D.	e^-	$\overline{\nu}_e$

63 – (PHYSI/10_SL_Winter_2022_Q24) – *Atomic,nuclear & Particle Physics*

Which development in physics constituted a paradigm shift?

A. The classification of variables into scalars and vectors

B. The determination of the velocity of light in different media

C. The equivalence of $F = ma$ to $F = \frac{\Delta p}{\Delta t}$ when the mass of the system is constant

D. The equivalence of mass and energy

64 – (PHYSI/10_SL_Winter_2022_Q25) – *Atomic,nuclear & Particle Physics*

A fusion reaction of one nucleus of hydrogen-2 and one nucleus of hydrogen-3 converts 0.019 u to energy. A fission reaction of one nucleus of uranium-235 converts a mass of 0.190 u to energy.

What is the ratio $\frac{\text{specific energy of this fusion of hydrogen}}{\text{specific energy of this fission of uranium}}$?

A. 0.1

B. 0.2

C. 5

D. 10

65 – (PHYSI/10_SL_Winter_2022_Q26) – *Atomic,nuclear & Particle Physics*

Three statements about the atom are:

I. The nucleus of the atom is positively charged.

II. The electrons provide only a small fraction of the mass of an atom.

III. Most of the atom is free space.

Which statements are correct?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

1 – (PHYSI/11_SL_Summer_2017_Q28) – *Energy Production*

The following are energy sources.

I. a battery of rechargeable electric cells

II. crude oil

III. a pumped storage hydroelectric system

Which of these are secondary energy sources?

A. I and II only

B. I and III only

C. II and III only

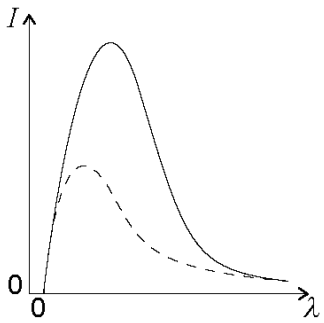
D. I, II and III

2 – (PHYSI/11_SL_Summer_2017_Q29) – *Energy Production*

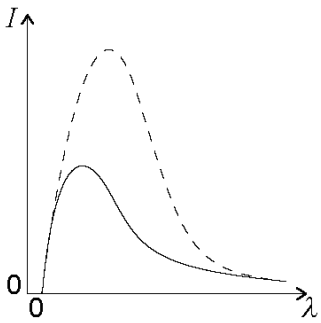
Planet X and planet Y both emit radiation as black bodies. Planet X has a surface temperature that is less than the surface temperature of planet Y.

What is the graph of the variation of intensity I with wavelength λ for the radiation emitted by planet Y? The graph for planet X is shown dotted.

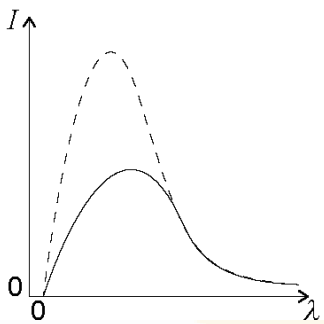
A.



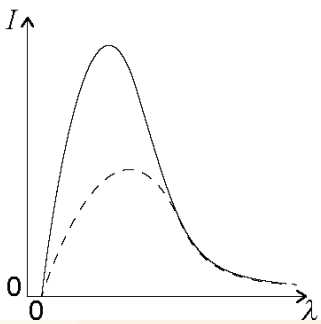
B.



C.



D.



3 – (PHYSI/11_SL_Summer_2017_Q30) – *Energy Production*

The average surface temperature of Mars is approximately 200 K and the average surface temperature of Earth is approximately 300 K. Mars has a radius half that of Earth. Assume that both Mars and Earth act as black bodies.

What is $\frac{\text{power radiated by Mars}}{\text{power radiated by Earth}}$?

A. 20

B. 5

C. 0.2

D. 0.05

4 – (PHYSI/12_SL_Summer_2017_Q28) – *Energy Production*

The main role of a moderator in a nuclear fission reactor is to

A. slow down neutrons.

B. absorb neutrons.

C. reflect neutrons back to the reactor.

D. accelerate neutrons.

5 – (PHYSI/12_SL_Summer_2017_Q29) – *Energy Production*

A room is at a constant temperature of 300 K. A hotplate in the room is at a temperature of 400 K and loses energy by radiation at a rate of P. What is the rate of loss of energy from the hotplate when its temperature is 500 K?

A. $\frac{4^4}{5^4}P$

B. $\frac{5^4+3^4}{4^4+3^4}P$

C. $\frac{5^4}{4^4}P$

D. $\frac{5^4-3^4}{4^4-3^4}P$

6 – (PHYSI/12_SL_Summer_2017_Q30) – *Energy Production*

In physics, a paradigm shift denotes the introduction of radically new ideas in order to explain a phenomenon. Which introduces a paradigm shift?

A. Multi-loop circuits

B. Standing waves

C. Total internal reflection

D. Atomic spectra

7 – (PHYSI/10_SL_Winter_2017_Q26) – *Energy Production*

Which of the energy sources are classified as renewable and non-renewable?

	Renewable	Non-renewable
A.	Sun	wind
B.	natural gas	geothermal
C.	biomass	crude oil
D.	uranium-235	coal

8 – (PHYSI/10_SL_Winter_2017_Q27) – *Energy Production*

The energy density of a substance can be calculated by multiplying its specific energy with which quantity?

A. mass

B. volume

C. $\frac{\text{mass}}{\text{volume}}$

D. $\frac{\text{volume}}{\text{mass}}$

9 – (PHYSI/10_SL_Winter_2017_Q28) – *Energy Production*

A black body emits radiation with its greatest intensity at a wavelength of λ_{max}. The surface temperature of the black body doubles without any other change occurring. What is the wavelength at which the greatest intensity of radiation is emitted?

A. λ_{max}

B. $\frac{\lambda_{max}}{2}$

C. $\frac{\lambda_{max}}{4}$

D. $\frac{\lambda_{max}}{16}$

10 – (PHYSI/10_SL_Winter_2017_Q29) – *Energy Production*

The three statements give possible reasons why an average value should be used for the solar constant.

I. The Sun's output varies during its 11 year cycle.

II. The Earth is in elliptical orbit around the Sun.

III. The plane of the Earth's spin on its axis is tilted to the plane of its orbit about the Sun.

Which are the correct reasons for using an average value for the solar constant?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

11 – (PHYSI/11_SL_Summer_2018_Q28) – *Energy Production*

What is equivalent to $\frac{\text{specific energy of a fuel}}{\text{energy density of a fuel}}$?

A. density of the fuel

B. $\frac{1}{\text{density of the fuel}}$

C. $\frac{\text{energy stored in the fuel}}{\text{density of the fuel}}$

D. $\frac{\text{density of the fuel}}{\text{energy stored in the fuel}}$

12 – (PHYSI/11_SL_Summer_2018_Q29) – *Energy Production*

Three energy sources for power stations are

I. fossil fuel
II. pumped water storage
III. nuclear fuel.

Which energy sources are primary sources?

A. I and II only

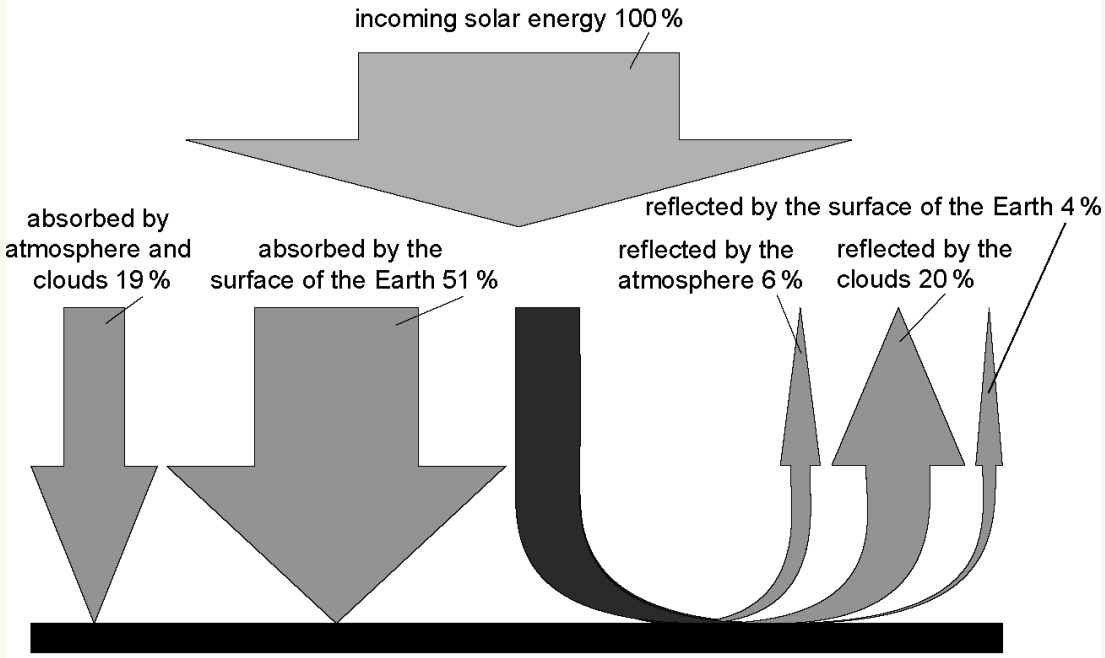
B. I and III only

C. II and III only

D. I, II and III

13 – (PHYSI/11_SL_Summer_2018_Q30) – *Energy Production*

The diagram shows a simple climate model for the Earth.



What does this model predict for the average albedo of the Earth?

A. 0.30

B. 0.51

C. 0.70

D. 0.81

14 – (PHYSI/12_SL_Summer_2018_Q28) – *Energy Production*

A wind turbine has a power output p when the wind speed is v. The efficiency of the wind turbine does not change. What is the wind speed at which the power output is $\frac{p}{2}$?

A. $\frac{v}{4}$

B. $\frac{v}{\sqrt{8}}$

C. $\frac{v}{2}$

D. $\frac{v}{\sqrt[3]{2}}$

15 – (PHYSI/12_SL_Summer_2018_Q29) – *Energy Production*

Three gases in the atmosphere are

I. carbon dioxide (CO_2)
II. dinitrogen monoxide (N_2O)
III. oxygen (O_2).

Which of these are considered to be greenhouse gases?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

16 – (PHYSI/12_SL_Summer_2018_Q30) – *Energy Production*

Mars and Earth act as black bodies. The $\frac{\text{power radiated by Mars}}{\text{power radiated by the Earth}} = p$ and $\frac{\text{absolute mean temperature of the surface of Mars}}{\text{absolute mean temperature of the surface of the Earth}} = t$.

What is the value of $\frac{\text{radius of Mars}}{\text{radius of the Earth}}$?

A. $\frac{p}{t^4}$

B. $\frac{\sqrt{p}}{t^2}$

C. $\frac{t^4}{p}$

D. $\frac{t^2}{\sqrt{p}}$

17 – (PHYSI/10_SL_Winter_2018_Q29) – *Energy Production*

A photovoltaic panel of area S has an efficiency of 20 %. A second photovoltaic panel has an efficiency of 15 %. What is the area of the second panel so that both panels produce the same power under the same conditions?

A. $\frac{S}{3}$

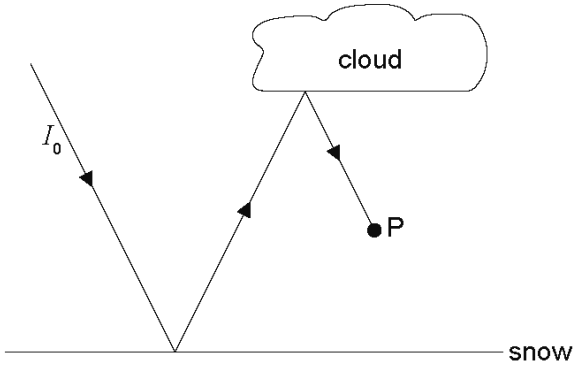
B. $\frac{3S}{4}$

C. $\frac{5S}{4}$

D. $\frac{4S}{3}$

18 – (PHYSI/10_SL_Winter_2018_Q30) – *Energy Production*

Light of intensity I_0 is incident on a snow-covered area of Earth. In a model of this situation, the albedo of the cloud is 0.30 and the albedo for the snow surface is 0.80. What is the intensity of the light at P due to the incident ray I_0?



A. $0.14\,I_0$

B. $0.24\,I_0$

C. $0.50\,I_0$

D. $0.55\,I_0$

19 – (PHYSI/11_SL_Summer_2019_Q30) – *Energy Production*

Most power stations rely on a turbine and a generator to produce electrical energy. Which power station works on a different principle?

A. Nuclear

B. Solar

C. Fossil fuel

D. Wind

20 – (PHYSI/12_SL_Summer_2019_Q29) – *Energy Production*

Three methods for the production of electrical energy are

I. wind turbine

II. photovoltaic cell

III. fossil fuel power station.

Which methods involve the use of a primary energy source?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

21 – (PHYSI/12_SL_Summer_2019_Q30) – *Energy Production*

The orbital radius of the Earth around the Sun is 1.5 times that of Venus. What is the intensity of solar radiation at the orbital radius of Venus?

A. $0.6\,kWm^{-2}$

B. $0.9\,kWm^{-2}$

C. $2\,kWm^{-2}$

D. $3\,kWm^{-2}$

22 – (PHYSI/10_SL_Winter_2019_Q28) – *Energy Production*

What are the units of specific energy and energy density?

	Specific energy	Energy density
A.	Jm^{-1}	Jm^{-2}
B.	Jkg^{-1}	Jm^{-3}
C.	Jkg^{-1}	Jm^{-2}
D.	Jm^{-1}	Jm^{-3}

23 – (PHYSI/10_SL_Winter_2019_Q29) – *Energy Production*

What is the function of the moderator in a thermal nuclear fission reactor?

A. To decrease the kinetic energy of neutrons emitted from fission reactions

B. To increase the kinetic energy of neutrons emitted from fission reactions

C. To decrease the overall number of neutrons available for fission

D. To increase the overall number of neutrons available for fission

24 – (PHYSI/10_SL_Winter_2019_Q30) – *Energy Production*

What is meant by the statement that the average albedo of the Moon is 0.1?

A. 10% of the radiation incident on the Moon is absorbed by its surface

B. 10% of the radiation emitted by the Moon is absorbed by its atmosphere

C. 10% of the radiation incident on the Moon is reflected by its surface

D. 10% of the radiation emitted by the Moon is at infrared wavelengths

25 – (PHYSI/10_SL_Winter_2020_Q26) – *Energy Production*

The average temperature of the surface of a planet is five times greater than the average temperature of the surface of its moon. The emissivities of the planet and the moon are the same. The average intensity radiated by the planet is I. What is the average intensity radiated by its moon?

A. $\frac{I}{25}$

B. $\frac{I}{125}$

C. $\frac{I}{625}$

D. $\frac{I}{3125}$

26 – (PHYSI/11_SL_Summer_2021_Q28) – *Energy Production*

Which change produces the largest percentage increase in the maximum theoretical power output of a wind turbine?

A. Doubling the area of the blades

B. Doubling the density of the fluid

C. Doubling the radius of the blades

D. Doubling the speed of the fluid

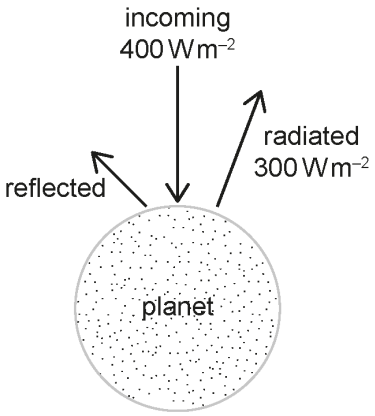
27 – (PHYSI/11_SL_Summer_2021_Q29) – *Energy Production*

A black body at temperature T emits radiation with peak wavelength λ_p and power P. What is the temperature of the black body and the power emitted for a peak wavelength of $\frac{\lambda_p}{2}$?

	Temperature of the black body	Power emitted by the black body
A.	$\frac{T}{2}$	$\frac{P}{16}$
B.	$\frac{T}{2}$	$\frac{P}{4}$
C.	$2T$	$4P$
D.	$2T$	$16P$

28 – (PHYSI/11_SL_Summer_2021_Q30) – *Energy Production*

In a simple climate model for a planet, the incoming intensity is $400\,\text{Wm}^{-2}$ and the radiated intensity is $300\,\text{Wm}^{-2}$.



The temperature of the planet is constant. What are the reflected intensity from the planet and the albedo of the planet?

	Reflected intensity from the planet	Albedo of the planet
A.	$100\,\text{Wm}^{-2}$	0.25
B.	$100\,\text{Wm}^{-2}$	0.75
C.	$300\,\text{Wm}^{-2}$	0.25
D.	$300\,\text{Wm}^{-2}$	0.75

29 – (PHYSI/12_SL_Summer_2021_Q29) – *Energy Production*

A black-body radiator emits a peak wavelength of λ_{max} and a maximum power of P_0. The peak wavelength emitted by a second black-body radiator with the same surface area is $2\,\lambda_{max}$. What is the total power of the second black-body radiator?

A. $\frac{1}{16}P_0$

B. $\frac{1}{2}P_0$

C. $2P_0$

D. $16P_0$

30 – (PHYSI/12_SL_Summer_2021_Q30) – *Energy Production*

What is the main role of carbon dioxide in the greenhouse effect?

A. It absorbs incoming radiation from the Sun.

B. It absorbs outgoing radiation from the Earth.

C. It reflects incoming radiation from the Sun.

D. It reflects outgoing radiation from the Earth.

31 – (PHYSI/10_SL_Winter_2021_Q28) – *Energy Production*

A fuel has mass density ρ and energy density u. What mass of the fuel has to be burned to release thermal energy E?

A. $\frac{\rho E}{u}$

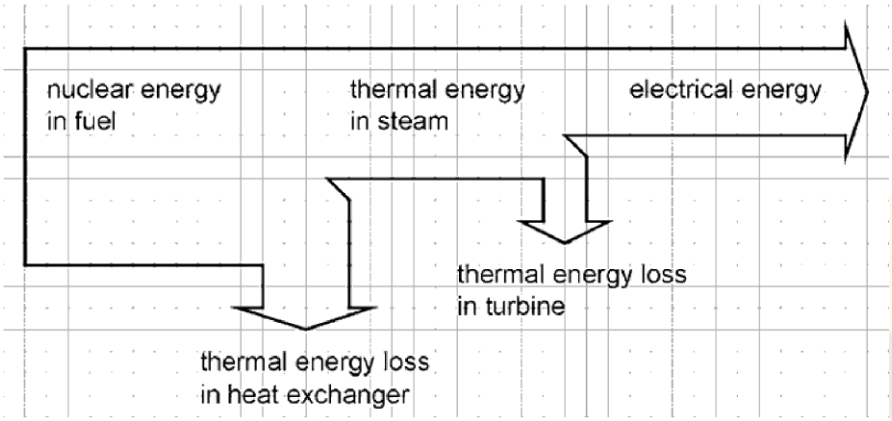
B. $\frac{uE}{\rho}$

C. $\frac{\rho u}{E}$

D. ρuE

32 – (PHYSI/10_SL_Winter_2021_Q29) – *Energy Production*

The Sankey diagram shows the energy transfers in a nuclear power station.



Electrical power output of the power station is 1000 MW.

What is the thermal power loss in the heat exchanger?

A. 500 MW

B. 1000 MW

C. 1500 MW

D. 2500 MW

33 – (PHYSI/10_SL_Winter_2021_Q30) – *Energy Production*

Which is correct for a black-body radiator?

A. The power it emits from a unit surface area depends on the temperature only.

B. It has an albedo of 1.

C. It emits monochromatic radiation whose wavelength depends on the temperature only.

D. It emits radiation of equal intensity at all wavelengths.

34 – (PHYSI/11_SL_Summer_2022_Q28) – *Energy Production*

Wind of speed v flows through a wind generator. The wind speed drops to $\frac{v}{3}$ after passing through the blades. What is the maximum possible efficiency of the generator?

A. $\frac{1}{27}$

B. $\frac{8}{27}$

C. $\frac{19}{27}$

D. $\frac{26}{27}$

35 – (PHYSI/11_SL_Summer_2022_Q29) – *Energy Production*

Three mechanisms that affect the composition of the atmosphere of the Earth are:

I. Loss of forests that would otherwise store carbon dioxide – CO_2

II. Release of methane – CH_4 by the digestive system of grazing animals

III. Increase of nitrous oxide – N_2O due to extensive use of fertilizer

Which of these statements describe a process that contributes to global warming?

A. I and II only

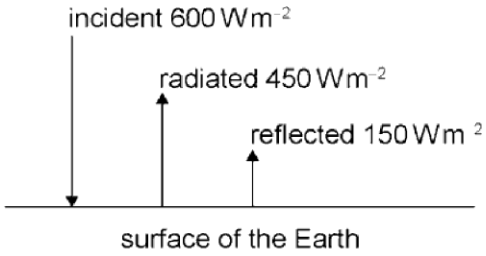
B. I and III only

C. II and III only

D. I, II and III

36 – (PHYSI/11_SL_Summer_2022_Q30) – *Energy Production*

The diagram shows, for a region on the Earth's surface, the incident, radiated and reflected intensities of the solar radiation.



What is the albedo of the region?

A. $\frac{1}{4}$

B. $\frac{1}{3}$

C. $\frac{3}{4}$

D. 1

37 – (PHYSI/12_SL_Summer_2022_Q28) – *Energy Production*

The age of the Earth is about 4.5×10^9 years.

What area of physics provides experimental evidence for this conclusion?

A. Newtonian mechanics

B. Optics

C. Radioactivity

D. Electromagnetism

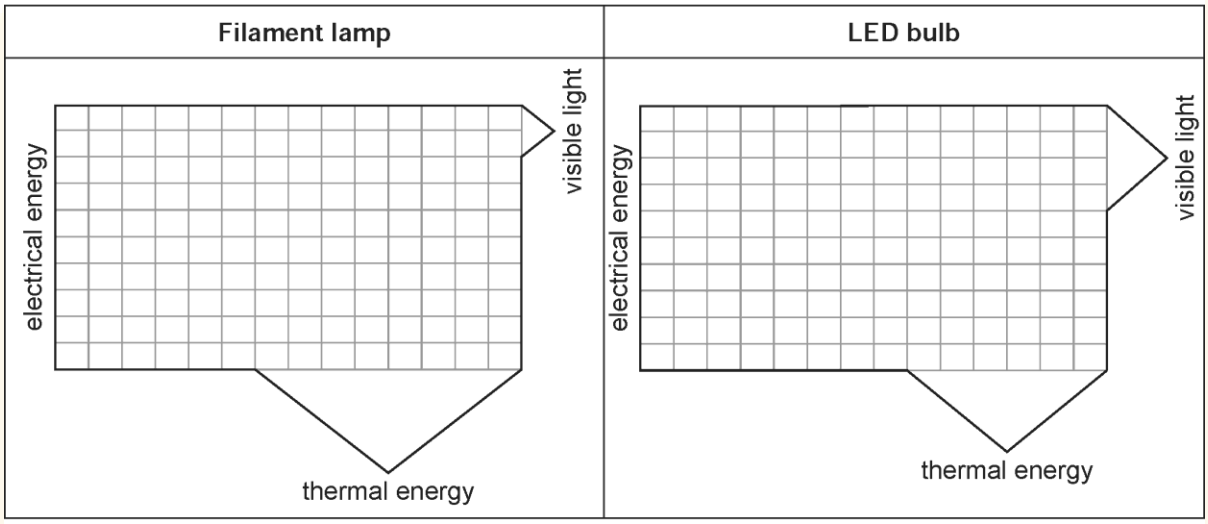
38 – (PHYSI/12_SL_Summer_2022_Q29) – *Energy Production*

Photovoltaic cells and solar heating panels are used to transfer the electromagnetic energy of the Sun's rays into other forms of energy. What is the form of energy into which solar energy is transferred in photovoltaic cells and solar heating panels?

	Photovoltaic cells	Solar heating panels
A.	electrical energy	thermal energy
B.	thermal energy	thermal energy
C.	electrical energy	electrical energy
D.	thermal energy	electrical energy

39 – (PHYSI/12_SL_Summer_2022_Q30) – *Energy Production*

The Sankey diagrams for a filament lamp and for an LED bulb are shown below.



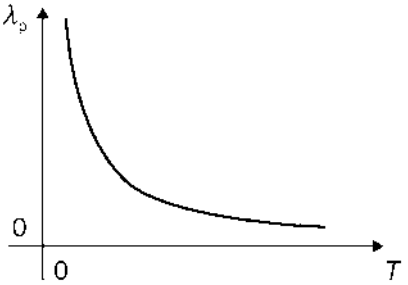
What is the efficiency of the filament lamp and the LED bulb?

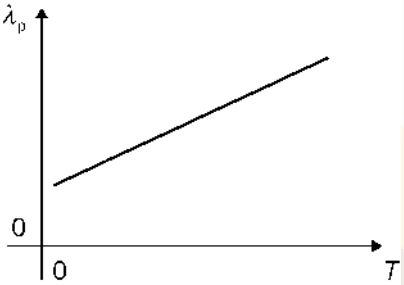
	Filament lamp	LED bulb
A.	20%	40%
B.	25%	40%
C.	20%	67%
D.	25%	67%

40 – (PHYSI/10_SL_Winter_2022_Q27) – *Energy Production*

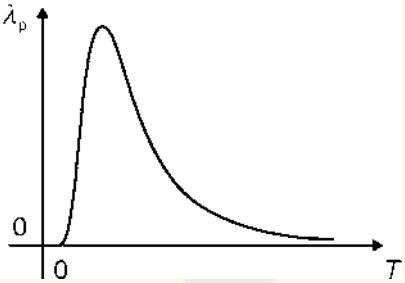
The electromagnetic spectrum radiated by a black body at temperature T shows a peak at wavelength λ_p.

What is the variation of λ_p with T?

A. 

B. 

C. 

D. 

41 – (PHYSI/10_SL_Winter_2022_Q28) – *Energy Production*

Water is to be pumped through a vertical height difference of 12.5 m. The pump is driven by a wind turbine that has an efficiency of 50 % and an area swept by the blades of 100 m^2. The average wind speed is 5.0 $m\,s^{-1}$ and the air density is 1.2 $kg\,m^{-3}$.

What is the maximum mass of water that can be pumped every second?

A. 3 kg

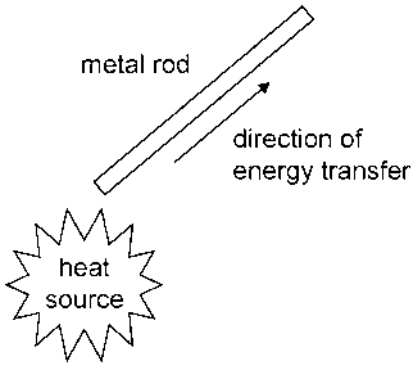
B. 30 kg

C. 60 kg

D. 120 kg

42 – (PHYSI/10_SL_Winter_2022_Q29) – *Energy Production*

When heating a metal rod at one end, thermal energy is transferred along the rod.



Which statement explains this transfer?

A. Free electrons transfer kinetic energy to the ions in the metal

B. Intermolecular potential energy increases throughout the metal

C. Intermolecular potential energy is transferred to kinetic energy

D. Ions in the metal radiate energy in all directions

43 – (PHYSI/10_SL_Winter_2022_Q30) – *Energy Production*

Planet X and planet Y both emit radiation as black bodies. Planet Y has twice the surface temperature and one third of the radius of planet X.

What is $\frac{\text{power radiated by planet X}}{\text{power radiated by planet Y}}$?

A. $\frac{9}{16}$

B. $\frac{3}{4}$

C. $\frac{4}{3}$

D. $\frac{16}{9}$

1 – (PHYSI/10_SL_Winter_2018_Q17) – *Oscillations & Waves, Wave Phenomena (ahl)*

Two strings of lengths L_1 and L_2 are fixed at both ends. The wavespeed is the same for both strings. They both vibrate at the same frequency. L_1 vibrates at its first harmonic. L_2 vibrates at its third harmonic.

What is $\frac{L_2}{L_1}$?

A. $\frac{1}{3}$

B. 1

C. 2

D. 3

ANSWERS

1 – (PHYSI/11_SL_Summer_2017_Q1) – *Measurements & Uncertainties*

C

2 – (PHYSI/11_SL_Summer_2017_Q2) – *Measurements & Uncertainties*

C

3 – (PHYSI/12_SL_Summer_2017_Q1) – *Measurements & Uncertainties*

D

4 – (PHYSI/12_SL_Summer_2017_Q2) – *Measurements & Uncertainties*

D

5 – (PHYSI/10_SL_Winter_2017_Q1) – *Measurements & Uncertainties*

B

6 – (PHYSI/10_SL_Winter_2017_Q2) – *Measurements & Uncertainties*

C

7 – (PHYSI/10_SL_Winter_2017_Q30) – *Measurements & Uncertainties*

B

8 – (PHYSI/11_SL_Summer_2018_Q1) – *Measurements & Uncertainties*

B

9 – (PHYSI/12_SL_Summer_2018_Q1) – *Measurements & Uncertainties*

C

10 – (PHYSI/10_SL_Winter_2018_Q1) – *Measurements & Uncertainties*

D

11 – (PHYSI/10_SL_Winter_2018_Q2) – *Measurements & Uncertainties*

D

12 – (PHYSI/11_SL_Summer_2019_Q1) – *Measurements & Uncertainties*

C

13 – (PHYSI/11_SL_Summer_2019_Q2) – *Measurements & Uncertainties*

A

14 – (PHYSI/12_SL_Summer_2019_Q1) – *Measurements & Uncertainties*

A

15 – (PHYSI/12_SL_Summer_2019_Q2) – *Measurements & Uncertainties*

C

16 – (PHYSI/10_SL_Winter_2019_Q1) – *Measurements & Uncertainties*

D

17 – (PHYSI/10_SL_Winter_2020_Q1) – *Measurements & Uncertainties*

D

18 – (PHYSI/10_SL_Winter_2020_Q2) – *Measurements & Uncertainties*

C

19 – (PHYSI/11_SL_Summer_2021_Q1) – *Measurements & Uncertainties*

D

20 – (PHYSI/11_SL_Summer_2021_Q2) – *Measurements & Uncertainties*

D

21 – (PHYSI/12_SL_Summer_2021_Q1) – *Measurements & Uncertainties*

B

22 – (PHYSI/12_SL_Summer_2021_Q2) – *Measurements & Uncertainties*

D

23 – (PHYSI/10_SL_Winter_2021_Q1) – *Measurements & Uncertainties*

A

24 – (PHYSI/10_SL_Winter_2021_Q2) – *Measurements & Uncertainties*

C

25 – (PHYSI/11_SL_Summer_2022_Q1) – *Measurements & Uncertainties*

B

26 – (PHYSI/11_SL_Summer_2022_Q2) – *Measurements & Uncertainties*

D

27 – (PHYSI/11_SL_Summer_2022_Q3) – *Measurements & Uncertainties*

C

28 – (PHYSI/12_SL_Summer_2022_Q1) – *Measurements & Uncertainties*

D

29 – (PHYSI/12_SL_Summer_2022_Q2) – *Measurements & Uncertainties*

C

30 – (PHYSI/12_SL_Summer_2022_Q3) – *Measurements & Uncertainties*

D

31 – (PHYSI/10_SL_Winter_2022_Q1) – *Measurements & Uncertainties*

B

1 – (PHYSI/11_SL_Summer_2017_Q3) – *Mechanics*

C

2 – (PHYSI/11_SL_Summer_2017_Q4) – *Mechanics*

B

3 – (PHYSI/11_SL_Summer_2017_Q5) – *Mechanics*

A

4 – (PHYSI/11_SL_Summer_2017_Q6) – *Mechanics*

B

5 – (PHYSI/11_SL_Summer_2017_Q7) – *Mechanics*

C

6 – (PHYSI/11_SL_Summer_2017_Q8) – *Mechanics*

D

7 – (PHYSI/11_SL_Summer_2017_Q9) – *Mechanics*

A

8 – (PHYSI/12_SL_Summer_2017_Q3) – *Mechanics*

B

9 – (PHYSI/12_SL_Summer_2017_Q4) – *Mechanics*

B

10 – (PHYSI/12_SL_Summer_2017_Q5) – *Mechanics*

B

11 – (PHYSI/12_SL_Summer_2017_Q6) – *Mechanics*

A

12 – (PHYSI/12_SL_Summer_2017_Q7) – *Mechanics*

B

13 – (PHYSI/12_SL_Summer_2017_Q8) – *Mechanics*

B

14 – (PHYSI/12_SL_Summer_2017_Q9) – *Mechanics*

D

15 – (PHYSI/10_SL_Winter_2017_Q3) – *Mechanics*

A

16 – (PHYSI/10_SL_Winter_2017_Q4) – *Mechanics*

B

17 – (PHYSI/10_SL_Winter_2017_Q5) – *Mechanics*

D

18 – (PHYSI/10_SL_Winter_2017_Q6) – *Mechanics*

C

19 – (PHYSI/10_SL_Winter_2017_Q7) – *Mechanics*

B

20 – (PHYSI/10_SL_Winter_2017_Q8) – *Mechanics*

A

21 – (PHYSI/11_SL_Summer_2018_Q2) – *Mechanics*

C

22 – (PHYSI/11_SL_Summer_2018_Q3) – *Mechanics*

A

23 – (PHYSI/11_SL_Summer_2018_Q4) – *Mechanics*

B

24 – (PHYSI/11_SL_Summer_2018_Q5) – *Mechanics*

A

25 – (PHYSI/11_SL_Summer_2018_Q6) – *Mechanics*

D

26 – (PHYSI/11_SL_Summer_2018_Q7) – *Mechanics*

C

27 – (PHYSI/11_SL_Summer_2018_Q8) – *Mechanics*

D

28 – (PHYSI/11_SL_Summer_2018_Q9) – *Mechanics*

B

29 – (PHYSI/12_SL_Summer_2018_Q2) – *Mechanics*

D

30 – (PHYSI/12_SL_Summer_2018_Q3) – *Mechanics*

B

31 – (PHYSI/12_SL_Summer_2018_Q4) – *Mechanics*

D

32 – (PHYSI/12_SL_Summer_2018_Q5) – *Mechanics*

B

33 – (PHYSI/12_SL_Summer_2018_Q6) – *Mechanics*

B

34 – (PHYSI/12_SL_Summer_2018_Q7) – *Mechanics*

C

35 – (PHYSI/12_SL_Summer_2018_Q8) – *Mechanics*

A

36 – (PHYSI/12_SL_Summer_2018_Q9) – *Mechanics*

C

37 – (PHYSI/12_SL_Summer_2018_Q10) – *Mechanics*

B

38 – (PHYSI/10_SL_Winter_2018_Q3) – *Mechanics*

C

39 – (PHYSI/10_SL_Winter_2018_Q4) – *Mechanics*

A

40 – (PHYSI/10_SL_Winter_2018_Q5) – *Mechanics*

A

41 – (PHYSI/10_SL_Winter_2018_Q6) – *Mechanics*

A

42 – (PHYSI/10_SL_Winter_2018_Q8) – *Mechanics*

B

43 – (PHYSI/10_SL_Winter_2018_Q9) – *Mechanics*

D

44 – (PHYSI/11_SL_Summer_2019_Q3) – *Mechanics*

C

45 – (PHYSI/11_SL_Summer_2019_Q4) – *Mechanics*

B

46 – (PHYSI/11_SL_Summer_2019_Q5) – *Mechanics*

B

47 – (PHYSI/11_SL_Summer_2019_Q6) – *Mechanics*

A

48 – (PHYSI/11_SL_Summer_2019_Q7) – *Mechanics*

A

49 – (PHYSI/11_SL_Summer_2019_Q8) – *Mechanics*

A

50 – (PHYSI/12_SL_Summer_2019_Q3) – *Mechanics*

D

51 – (PHYSI/12_SL_Summer_2019_Q4) – *Mechanics*

A

52 – (PHYSI/12_SL_Summer_2019_Q5) – *Mechanics*

B

53 – (PHYSI/12_SL_Summer_2019_Q7) – *Mechanics*

D

54 – (PHYSI/12_SL_Summer_2019_Q8) – *Mechanics*

A

55 – (PHYSI/12_SL_Summer_2019_Q9) – *Mechanics*

D

56 – (PHYSI/10_SL_Winter_2019_Q2) – *Mechanics*

A

57 – (PHYSI/10_SL_Winter_2019_Q3) – *Mechanics*

C

58 – (PHYSI/10_SL_Winter_2019_Q4) – *Mechanics*

B

59 – (PHYSI/10_SL_Winter_2019_Q5) – *Mechanics*

C

60 – (PHYSI/10_SL_Winter_2019_Q6) – *Mechanics*

B

61 – (PHYSI/10_SL_Winter_2019_Q7) – *Mechanics*

D

62 – (PHYSI/10_SL_Winter_2019_Q8) – *Mechanics*

D

63 – (PHYSI/10_SL_Winter_2020_Q3) – *Mechanics*

B

64 – (PHYSI/10_SL_Winter_2020_Q4) – *Mechanics*

B

65 – (PHYSI/10_SL_Winter_2020_Q5) – *Mechanics*

B

66 – (PHYSI/10_SL_Winter_2020_Q6) – *Mechanics*

B

67 – (PHYSI/10_SL_Winter_2020_Q7) – *Mechanics*

D

68 – (PHYSI/10_SL_Winter_2020_Q8) – *Mechanics*

C

69 – (PHYSI/10_SL_Winter_2020_Q9) – *Mechanics*

D

70 – (PHYSI/10_SL_Winter_2020_Q10) – *Mechanics*

D

71 – (PHYSI/11_SL_Summer_2021_Q3) – *Mechanics*

D

72 – (PHYSI/11_SL_Summer_2021_Q4) – *Mechanics*

C

73 – (PHYSI/11_SL_Summer_2021_Q5) – *Mechanics*

C

74 – (PHYSI/11_SL_Summer_2021_Q6) – *Mechanics*

A

75 – (PHYSI/11_SL_Summer_2021_Q7) – *Mechanics*

C

76 – (PHYSI/11_SL_Summer_2021_Q8) – *Mechanics*

C

77 – (PHYSI/11_SL_Summer_2021_Q9) – *Mechanics*

C

78 – (PHYSI/12_SL_Summer_2021_Q3) – *Mechanics*

A

79 – (PHYSI/12_SL_Summer_2021_Q4) – *Mechanics*

A

80 – (PHYSI/12_SL_Summer_2021_Q5) – *Mechanics*

D

81 – (PHYSI/12_SL_Summer_2021_Q6) – *Mechanics*

B

82 – (PHYSI/12_SL_Summer_2021_Q7) – *Mechanics*

B

83 – (PHYSI/12_SL_Summer_2021_Q8) – *Mechanics*

A

84 – (PHYSI/12_SL_Summer_2021_Q9) – *Mechanics*

B

85 – (PHYSI/10_SL_Winter_2021_Q3) – *Mechanics*

A

86 – (PHYSI/10_SL_Winter_2021_Q4) – *Mechanics*

D

87 – (PHYSI/10_SL_Winter_2021_Q5) – *Mechanics*

C

88 – (PHYSI/10_SL_Winter_2021_Q6) – *Mechanics*

A

89 – (PHYSI/10_SL_Winter_2021_Q7) – *Mechanics*

B

90 – (PHYSI/10_SL_Winter_2021_Q8) – *Mechanics*

B

91 – (PHYSI/10_SL_Winter_2021_Q9) – *Mechanics*

D

92 – (PHYSI/11_SL_Summer_2022_Q4) – *Mechanics*

B

93 – (PHYSI/11_SL_Summer_2022_Q5) – *Mechanics*

B

94 – (PHYSI/11_SL_Summer_2022_Q6) – *Mechanics*

A

95 – (PHYSI/11_SL_Summer_2022_Q7) – *Mechanics*

A

96 – (PHYSI/11_SL_Summer_2022_Q8) – *Mechanics*

D

97 – (PHYSI/11_SL_Summer_2022_Q9) – *Mechanics*

A

98 – (PHYSI/12_SL_Summer_2022_Q4) – *Mechanics*

D

99 – (PHYSI/12_SL_Summer_2022_Q5) – *Mechanics*

C

100 – (PHYSI/12_SL_Summer_2022_Q6) – *Mechanics*

A

101 – (PHYSI/12_SL_Summer_2022_Q7) – *Mechanics*

B

102 – (PHYSI/12_SL_Summer_2022_Q8) – *Mechanics*

B

103 – (PHYSI/12_SL_Summer_2022_Q9) – *Mechanics*

C

104 – (PHYSI/10_SL_Winter_2022_Q2) – *Mechanics*

D

105 – (PHYSI/10_SL_Winter_2022_Q3) – *Mechanics*

C

106 – (PHYSI/10_SL_Winter_2022_Q4) – *Mechanics*

D

107 – (PHYSI/10_SL_Winter_2022_Q5) – *Mechanics*

B

108 – (PHYSI/10_SL_Winter_2022_Q6) – *Mechanics*

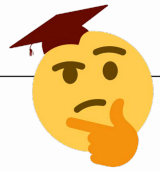
C

109 – (PHYSI/10_SL_Winter_2022_Q7) – *Mechanics*

B

1 – (PHYSI/11_SL_Summer_2017_Q10) – *Thermal Physics*

A



2 – (PHYSI/11_SL_Summer_2017_Q11) – *Thermal Physics*

A

3 – (PHYSI/11_SL_Summer_2017_Q12) – *Thermal Physics*

C

4 – (PHYSI/12_SL_Summer_2017_Q10) – *Thermal Physics*

D

5 – (PHYSI/12_SL_Summer_2017_Q11) – *Thermal Physics*

C

6 – (PHYSI/12_SL_Summer_2017_Q12) – *Thermal Physics*

A

7 – (PHYSI/10_SL_Winter_2017_Q9) – *Thermal Physics*

B

8 – (PHYSI/10_SL_Winter_2017_Q10) – *Thermal Physics*

B

9 – (PHYSI/10_SL_Winter_2017_Q11) – *Thermal Physics*

C

10 – (PHYSI/11_SL_Summer_2018_Q10) – *Thermal Physics*

A

11 – (PHYSI/11_SL_Summer_2018_Q11) – *Thermal Physics*

C

12 – (PHYSI/11_SL_Summer_2018_Q12) – *Thermal Physics*

D

13 – (PHYSI/12_SL_Summer_2018_Q11) – *Thermal Physics*

A

14 – (PHYSI/12_SL_Summer_2018_Q12) – *Thermal Physics*

A

15 – (PHYSI/12_SL_Summer_2018_Q13) – *Thermal Physics*

A

16 – (PHYSI/10_SL_Winter_2018_Q10) – *Thermal Physics*

C

17 – (PHYSI/10_SL_Winter_2018_Q11) – *Thermal Physics*

C

18 – (PHYSI/10_SL_Winter_2018_Q12) – *Thermal Physics*

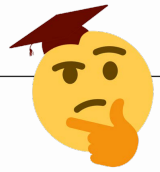
C

19 – (PHYSI/11_SL_Summer_2019_Q10) – *Thermal Physics*

D

20 – (PHYSI/11_SL_Summer_2019_Q11) – *Thermal Physics*

B



21 – (PHYSI/11_SL_Summer_2019_Q12) – *Thermal Physics*

B

22 – (PHYSI/11_SL_Summer_2019_Q13) – *Thermal Physics*

C

23 – (PHYSI/11_SL_Summer_2019_Q29) – *Thermal Physics*

C

24 – (PHYSI/12_SL_Summer_2019_Q10) – *Thermal Physics*

C

25 – (PHYSI/12_SL_Summer_2019_Q11) – *Thermal Physics*

B

26 – (PHYSI/12_SL_Summer_2019_Q12) – *Thermal Physics*

A

27 – (PHYSI/10_SL_Winter_2019_Q9) – *Thermal Physics*

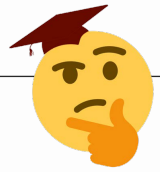
A

28 – (PHYSI/10_SL_Winter_2019_Q10) – *Thermal Physics*

D

29 – (PHYSI/10_SL_Winter_2019_Q11) – *Thermal Physics*

C



30 – (PHYSI/10_SL_Winter_2020_Q11) – *Thermal Physics*

B

31 – (PHYSI/10_SL_Winter_2020_Q12) – *Thermal Physics*

B

32 – (PHYSI/10_SL_Winter_2020_Q13) – *Thermal Physics*

A

33 – (PHYSI/11_SL_Summer_2021_Q10) – *Thermal Physics*

A

34 – (PHYSI/11_SL_Summer_2021_Q11) – *Thermal Physics*

D

35 – (PHYSI/11_SL_Summer_2021_Q12) – *Thermal Physics*

D

36 – (PHYSI/12_SL_Summer_2021_Q10) – *Thermal Physics*

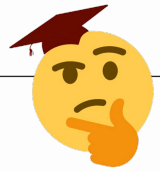
B

37 – (PHYSI/12_SL_Summer_2021_Q11) – *Thermal Physics*

C

38 – (PHYSI/12_SL_Summer_2021_Q12) – *Thermal Physics*

D



39 – (PHYSI/10_SL_Winter_2021_Q10) – *Thermal Physics*

B

40 – (PHYSI/10_SL_Winter_2021_Q11) – *Thermal Physics*

C

41 – (PHYSI/10_SL_Winter_2021_Q12) – *Thermal Physics*

C

42 – (PHYSI/11_SL_Summer_2022_Q10) – *Thermal Physics*

A

43 – (PHYSI/11_SL_Summer_2022_Q11) – *Thermal Physics*

C

44 – (PHYSI/11_SL_Summer_2022_Q12) – *Thermal Physics*

C

45 – (PHYSI/12_SL_Summer_2022_Q10) – *Thermal Physics*

C

46 – (PHYSI/12_SL_Summer_2022_Q11) – *Thermal Physics*

A

47 – (PHYSI/12_SL_Summer_2022_Q12) – *Thermal Physics*

C

48 – (PHYSI/12_SL_Summer_2022_Q13) – *Thermal Physics*

D

49 – (PHYSI/10_SL_Winter_2022_Q8) – *Thermal Physics*

D

50 – (PHYSI/10_SL_Winter_2022_Q9) – *Thermal Physics*

B

51 – (PHYSI/10_SL_Winter_2022_Q10) – *Thermal Physics*

A

1 – (PHYSI/11_SL_Summer_2017_Q13) – *Oscillations & Waves*

A

2 – (PHYSI/11_SL_Summer_2017_Q14) – *Oscillations & Waves*

B

3 – (PHYSI/11_SL_Summer_2017_Q15) – *Oscillations & Waves*

A

4 – (PHYSI/11_SL_Summer_2017_Q16) – *Oscillations & Waves*

C

5 – (PHYSI/11_SL_Summer_2017_Q17) – *Oscillations & Waves*

B

6 – (PHYSI/12_SL_Summer_2017_Q13) – *Oscillations & Waves*

D

7 – (PHYSI/12_SL_Summer_2017_Q14) – *Oscillations & Waves*

A

8 – (PHYSI/12_SL_Summer_2017_Q15) – *Oscillations & Waves*

B

9 – (PHYSI/12_SL_Summer_2017_Q16) – *Oscillations & Waves*

A

10 – (PHYSI/12_SL_Summer_2017_Q17) – *Oscillations & Waves*

C

11 – (PHYSI/10_SL_Winter_2017_Q12) – *Oscillations & Waves*

D

12 – (PHYSI/10_SL_Winter_2017_Q13) – *Oscillations & Waves*

C

13 – (PHYSI/10_SL_Winter_2017_Q14) – *Oscillations & Waves*

D

14 – (PHYSI/10_SL_Winter_2017_Q15) – *Oscillations & Waves*

A

15 – (PHYSI/10_SL_Winter_2017_Q16) – *Oscillations & Waves*

C

16 – (PHYSI/11_SL_Summer_2018_Q13) – *Oscillations & Waves*

D

17 – (PHYSI/11_SL_Summer_2018_Q14) – *Oscillations & Waves*

D

18 – (PHYSI/11_SL_Summer_2018_Q15) – *Oscillations & Waves*

C

19 – (PHYSI/11_SL_Summer_2018_Q16) – *Oscillations & Waves*

B

20 – (PHYSI/11_SL_Summer_2018_Q17) – *Oscillations & Waves*

D

21 – (PHYSI/12_SL_Summer_2018_Q14) – *Oscillations & Waves*

D

22 – (PHYSI/12_SL_Summer_2018_Q15) – *Oscillations & Waves*

D

23 – (PHYSI/12_SL_Summer_2018_Q16) – *Oscillations & Waves*

A

24 – (PHYSI/12_SL_Summer_2018_Q17) – *Oscillations & Waves*

C

25 – (PHYSI/12_SL_Summer_2018_Q18) – *Oscillations & Waves*

D

26 – (PHYSI/10_SL_Winter_2018_Q14) – *Oscillations & Waves*

B

27 – (PHYSI/10_SL_Winter_2018_Q15) – *Oscillations & Waves*

D

28 – (PHYSI/10_SL_Winter_2018_Q16) – *Oscillations & Waves*

C

29 – (PHYSI/10_SL_Winter_2018_Q17) – *Oscillations & Waves, Wave Phenomena (ahl)*

D

30 – (PHYSI/10_SL_Winter_2018_Q18) – *Oscillations & Waves*

A

31 – (PHYSI/11_SL_Summer_2019_Q14) – *Oscillations & Waves*

C

32 – (PHYSI/11_SL_Summer_2019_Q15) – *Oscillations & Waves*

D

33 – (PHYSI/11_SL_Summer_2019_Q16) – *Oscillations & Waves*

D

34 – (PHYSI/11_SL_Summer_2019_Q17) – *Oscillations & Waves*

B

35 – (PHYSI/11_SL_Summer_2019_Q18) – *Oscillations & Waves*

B

36 – (PHYSI/11_SL_Summer_2019_Q19) – *Oscillations & Waves*

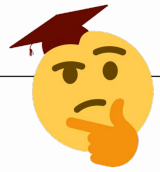
D

37 – (PHYSI/12_SL_Summer_2019_Q13) – *Oscillations & Waves*

C

38 – (PHYSI/12_SL_Summer_2019_Q14) – *Oscillations & Waves*

B



39 – (PHYSI/12_SL_Summer_2019_Q15) – *Oscillations & Waves*

B

40 – (PHYSI/12_SL_Summer_2019_Q16) – *Oscillations & Waves*

D

41 – (PHYSI/12_SL_Summer_2019_Q17) – *Oscillations & Waves*

D

42 – (PHYSI/10_SL_Winter_2019_Q12) – *Oscillations & Waves*

D

43 – (PHYSI/10_SL_Winter_2019_Q13) – *Oscillations & Waves*

C

44 – (PHYSI/10_SL_Winter_2019_Q14) – *Oscillations & Waves*

B

45 – (PHYSI/10_SL_Winter_2019_Q15) – *Oscillations & Waves*

C

46 – (PHYSI/10_SL_Winter_2019_Q16) – *Oscillations & Waves*

A

47 – (PHYSI/10_SL_Winter_2020_Q14) – *Oscillations & Waves*

D

48 – (PHYSI/10_SL_Winter_2020_Q15) – *Oscillations & Waves*

C

49 – (PHYSI/10_SL_Winter_2020_Q16) – *Oscillations & Waves*

B

50 – (PHYSI/10_SL_Winter_2020_Q17) – *Oscillations & Waves*

C

51 – (PHYSI/11_SL_Summer_2021_Q13) – *Oscillations & Waves*

A

52 – (PHYSI/11_SL_Summer_2021_Q14) – *Oscillations & Waves*

C

53 – (PHYSI/11_SL_Summer_2021_Q15) – *Oscillations & Waves*

D

54 – (PHYSI/11_SL_Summer_2021_Q16) – *Oscillations & Waves*

C

55 – (PHYSI/11_SL_Summer_2021_Q17) – *Oscillations & Waves*

B

56 – (PHYSI/12_SL_Summer_2021_Q13) – *Oscillations & Waves*

C

57 – (PHYSI/12_SL_Summer_2021_Q14) – *Oscillations & Waves*

B

58 – (PHYSI/12_SL_Summer_2021_Q15) – *Oscillations & Waves*

D

59 – (PHYSI/12_SL_Summer_2021_Q16) – *Oscillations & Waves*

C

60 – (PHYSI/12_SL_Summer_2021_Q17) – *Oscillations & Waves*

A

61 – (PHYSI/10_SL_Winter_2021_Q13) – *Oscillations & Waves*

D

62 – (PHYSI/10_SL_Winter_2021_Q14) – *Oscillations & Waves*

B

63 – (PHYSI/10_SL_Winter_2021_Q15) – *Oscillations & Waves*

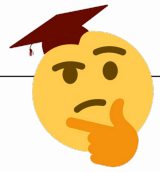
B

64 – (PHYSI/10_SL_Winter_2021_Q16) – *Oscillations & Waves*

D

65 – (PHYSI/10_SL_Winter_2021_Q17) – *Oscillations & Waves*

D



66 – (PHYSI/11_SL_Summer_2022_Q13) – *Oscillations & Waves*

C

67 – (PHYSI/11_SL_Summer_2022_Q14) – *Oscillations & Waves*

A

68 – (PHYSI/11_SL_Summer_2022_Q15) – *Oscillations & Waves*

C

69 – (PHYSI/11_SL_Summer_2022_Q16) – *Oscillations & Waves*

D

70 – (PHYSI/11_SL_Summer_2022_Q17) – *Oscillations & Waves*

B

71 – (PHYSI/11_SL_Summer_2022_Q18) – *Oscillations & Waves*

D

72 – (PHYSI/12_SL_Summer_2022_Q14) – *Oscillations & Waves*

D

73 – (PHYSI/12_SL_Summer_2022_Q15) – *Oscillations & Waves*

A

74 – (PHYSI/12_SL_Summer_2022_Q16) – *Oscillations & Waves*

C

75 – (PHYSI/12_SL_Summer_2022_Q17) – *Oscillations & Waves*

D

76 – (PHYSI/12_SL_Summer_2022_Q18) – *Oscillations & Waves*

A

77 – (PHYSI/10_SL_Winter_2022_Q11) – *Oscillations & Waves*

A

78 – (PHYSI/10_SL_Winter_2022_Q12) – *Oscillations & Waves*

D

79 – (PHYSI/10_SL_Winter_2022_Q13) – *Oscillations & Waves*

A

80 – (PHYSI/10_SL_Winter_2022_Q14) – *Oscillations & Waves*

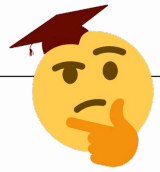
C

81 – (PHYSI/10_SL_Winter_2022_Q15) – *Oscillations & Waves*

B

1 – (PHYSI/11_SL_Summer_2017_Q18) – *Electricity & Magnetism*

C



2 – (PHYSI/11_SL_Summer_2017_Q19) – *Electricity & Magnetism*

C

3 – (PHYSI/11_SL_Summer_2017_Q20) – *Electricity & Magnetism*

D

4 – (PHYSI/11_SL_Summer_2017_Q21) – *Electricity & Magnetism*

A

5 – (PHYSI/12_SL_Summer_2017_Q18) – *Electricity & Magnetism*

C

6 – (PHYSI/12_SL_Summer_2017_Q19) – *Electricity & Magnetism*

B

7 – (PHYSI/12_SL_Summer_2017_Q20) – *Electricity & Magnetism*

C

8 – (PHYSI/12_SL_Summer_2017_Q21) – *Electricity & Magnetism*

A

9 – (PHYSI/10_SL_Winter_2017_Q17) – *Electricity & Magnetism*

C

10 – (PHYSI/10_SL_Winter_2017_Q18) – *Electricity & Magnetism*

B

11 – (PHYSI/10_SL_Winter_2017_Q19) – *Electricity & Magnetism*

B

12 – (PHYSI/10_SL_Winter_2017_Q20) – *Electricity & Magnetism*

A

13 – (PHYSI/11_SL_Summer_2018_Q18) – *Electricity & Magnetism*

A

14 – (PHYSI/11_SL_Summer_2018_Q19) – *Electricity & Magnetism*

A

15 – (PHYSI/11_SL_Summer_2018_Q20) – *Electricity & Magnetism*

C

16 – (PHYSI/11_SL_Summer_2018_Q21) – *Electricity & Magnetism*

D

17 – (PHYSI/12_SL_Summer_2018_Q19) – *Electricity & Magnetism*

C

18 – (PHYSI/12_SL_Summer_2018_Q20) – *Electricity & Magnetism*

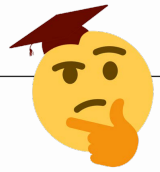
C

19 – (PHYSI/12_SL_Summer_2018_Q21) – *Electricity & Magnetism*

D

20 – (PHYSI/12_SL_Summer_2018_Q22) – *Electricity & Magnetism*

D



21 – (PHYSI/10_SL_Winter_2018_Q19) – *Electricity & Magnetism*

B

22 – (PHYSI/10_SL_Winter_2018_Q20) – *Electricity & Magnetism*

C

23 – (PHYSI/10_SL_Winter_2018_Q21) – *Electricity & Magnetism*

A

24 – (PHYSI/10_SL_Winter_2018_Q22) – *Electricity & Magnetism*

B

25 – (PHYSI/11_SL_Summer_2019_Q20) – *Electricity & Magnetism*

C

26 – (PHYSI/11_SL_Summer_2019_Q21) – *Electricity & Magnetism*

C

27 – (PHYSI/11_SL_Summer_2019_Q22) – *Electricity & Magnetism*

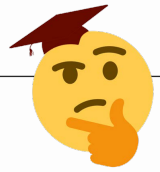
D

28 – (PHYSI/11_SL_Summer_2019_Q23) – *Electricity & Magnetism*

A

29 – (PHYSI/12_SL_Summer_2019_Q18) – *Electricity & Magnetism*

B



30 – (PHYSI/12_SL_Summer_2019_Q19) – *Electricity & Magnetism*

A

31 – (PHYSI/12_SL_Summer_2019_Q20) – *Electricity & Magnetism*

D

32 – (PHYSI/12_SL_Summer_2019_Q21) – *Electricity & Magnetism*

B

33 – (PHYSI/10_SL_Winter_2019_Q17) – *Electricity & Magnetism*

A

34 – (PHYSI/10_SL_Winter_2019_Q18) – *Electricity & Magnetism*

D

35 – (PHYSI/10_SL_Winter_2019_Q19) – *Electricity & Magnetism*

A

36 – (PHYSI/10_SL_Winter_2019_Q20) – *Electricity & Magnetism*

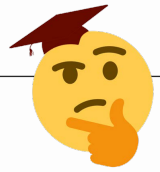
D

37 – (PHYSI/10_SL_Winter_2020_Q18) – *Electricity & Magnetism*

B

38 – (PHYSI/10_SL_Winter_2020_Q19) – *Electricity & Magnetism*

C



39 – (PHYSI/10_SL_Winter_2020_Q20) – *Electricity & Magnetism*

A

40 – (PHYSI/10_SL_Winter_2020_Q21) – *Electricity & Magnetism*

B

41 – (PHYSI/11_SL_Summer_2021_Q18) – *Electricity & Magnetism*

A

42 – (PHYSI/11_SL_Summer_2021_Q19) – *Electricity & Magnetism*

A

43 – (PHYSI/11_SL_Summer_2021_Q20) – *Electricity & Magnetism*

A

44 – (PHYSI/11_SL_Summer_2021_Q21) – *Electricity & Magnetism*

A

45 – (PHYSI/12_SL_Summer_2021_Q18) – *Electricity & Magnetism*

D

46 – (PHYSI/12_SL_Summer_2021_Q19) – *Electricity & Magnetism*

C

47 – (PHYSI/12_SL_Summer_2021_Q20) – *Electricity & Magnetism*

A

48 – (PHYSI/12_SL_Summer_2021_Q21) – *Electricity & Magnetism*

C

49 – (PHYSI/12_SL_Summer_2021_Q22) – *Electricity & Magnetism*

B

50 – (PHYSI/12_SL_Summer_2021_Q23) – *Electricity & Magnetism*

A

51 – (PHYSI/10_SL_Winter_2021_Q18) – *Electricity & Magnetism*

C

52 – (PHYSI/10_SL_Winter_2021_Q19) – *Electricity & Magnetism*

A

53 – (PHYSI/10_SL_Winter_2021_Q20) – *Electricity & Magnetism*

D

54 – (PHYSI/10_SL_Winter_2021_Q21) – *Electricity & Magnetism*

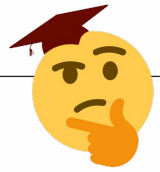
A

55 – (PHYSI/11_SL_Summer_2022_Q19) – *Electricity & Magnetism*

B

56 – (PHYSI/11_SL_Summer_2022_Q20) – *Electricity & Magnetism*

C



57 – (PHYSI/11_SL_Summer_2022_Q21) – *Electricity & Magnetism*

C

58 – (PHYSI/11_SL_Summer_2022_Q22) – *Electricity & Magnetism*

B

59 – (PHYSI/12_SL_Summer_2022_Q19) – *Electricity & Magnetism*

A

60 – (PHYSI/12_SL_Summer_2022_Q20) – *Electricity & Magnetism*

A

61 – (PHYSI/12_SL_Summer_2022_Q21) – *Electricity & Magnetism*

B

62 – (PHYSI/12_SL_Summer_2022_Q22) – *Electricity & Magnetism*

B

63 – (PHYSI/10_SL_Winter_2022_Q16) – *Electricity & Magnetism*

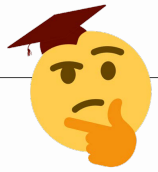
B

64 – (PHYSI/10_SL_Winter_2022_Q17) – *Electricity & Magnetism*

B

65 - (PHYSI/10_SL_Winter_2022_Q18) **–** *Electricity & Magnetism*

B



66 - (PHYSI/10_SL_Winter_2022_Q19) **–** *Electricity & Magnetism*

D

1 – (PHYSI/11_SL_Summer_2017_Q22) – *Circular Motion & Gravitation*

B

2 – (PHYSI/11_SL_Summer_2017_Q23) – *Circular Motion & Gravitation*

A

3 – (PHYSI/12_SL_Summer_2017_Q22) – *Circular Motion & Gravitation*

A

4 – (PHYSI/12_SL_Summer_2017_Q23) – *Circular Motion & Gravitation*

C

5 – (PHYSI/10_SL_Winter_2017_Q21) – *Circular Motion & Gravitation*

B

6 – (PHYSI/10_SL_Winter_2017_Q22) – *Circular Motion & Gravitation*

B

7 – (PHYSI/11_SL_Summer_2018_Q22) – *Circular Motion & Gravitation*

A

8 – (PHYSI/11_SL_Summer_2018_Q23) – *Circular Motion & Gravitation*

C

9 – (PHYSI/12_SL_Summer_2018_Q23) – *Circular Motion & Gravitation*

D

10 – (PHYSI/10_SL_Winter_2018_Q7) – *Circular Motion & Gravitation*

A

11 – (PHYSI/10_SL_Winter_2018_Q13) – *Circular Motion & Gravitation*

B

12 – (PHYSI/10_SL_Winter_2018_Q23) – *Circular Motion & Gravitation*

C

13 – (PHYSI/11_SL_Summer_2019_Q9) – *Circular Motion & Gravitation*

C

14 – (PHYSI/11_SL_Summer_2019_Q24) – *Circular Motion & Gravitation*

A

15 – (PHYSI/11_SL_Summer_2019_Q25) – *Circular Motion & Gravitation*

D

16 – (PHYSI/12_SL_Summer_2019_Q22) – *Circular Motion & Gravitation*

D

17 – (PHYSI/12_SL_Summer_2019_Q23) – *Circular Motion & Gravitation*

D

18 – (PHYSI/10_SL_Winter_2019_Q21) – *Circular Motion & Gravitation*

A

19 – (PHYSI/10_SL_Winter_2019_Q22) – *Circular Motion & Gravitation*

C

20 – (PHYSI/10_SL_Winter_2019_Q23) – *Circular Motion & Gravitation*

A

21 – (PHYSI/10_SL_Winter_2020_Q22) – *Circular Motion & Gravitation*

D

22 – (PHYSI/10_SL_Winter_2020_Q23) – *Circular Motion & Gravitation*

C

23 – (PHYSI/11_SL_Summer_2021_Q22) – *Circular Motion & Gravitation*

B

24 – (PHYSI/11_SL_Summer_2021_Q23) – *Circular Motion & Gravitation*

B

25 – (PHYSI/12_SL_Summer_2021_Q24) – *Circular Motion & Gravitation*

D

26 – (PHYSI/10_SL_Winter_2021_Q22) – *Circular Motion & Gravitation*

D

27 – (PHYSI/10_SL_Winter_2021_Q23) – *Circular Motion & Gravitation*

B

28 – (PHYSI/11_SL_Summer_2022_Q23) – *Circular Motion & Gravitation*

B

29 – (PHYSI/12_SL_Summer_2022_Q23) **–** *Circular Motion & Gravitation*

D

30 – (PHYSI/12_SL_Summer_2022_Q24) **–** *Circular Motion & Gravitation*

B

31 – (PHYSI/10_SL_Winter_2022_Q20) **–** *Circular Motion & Gravitation*

C

32 – (PHYSI/10_SL_Winter_2022_Q21) **–** *Circular Motion & Gravitation*

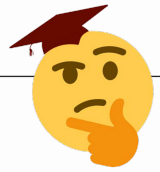
D

33 – (PHYSI/10_SL_Winter_2022_Q22) **–** *Circular Motion & Gravitation*

C

1 – (PHYSI/11_SL_Summer_2017_Q24) – *Atomic,nuclear & Particle Physics*

D



2 – (PHYSI/11_SL_Summer_2017_Q25) – *Atomic,nuclear & Particle Physics*

A

3 – (PHYSI/11_SL_Summer_2017_Q26) – *Atomic,nuclear & Particle Physics*

A

4 – (PHYSI/11_SL_Summer_2017_Q27) – *Atomic,nuclear & Particle Physics*

D

5 – (PHYSI/12_SL_Summer_2017_Q24) – *Atomic,nuclear & Particle Physics*

A

6 – (PHYSI/12_SL_Summer_2017_Q25) – *Atomic,nuclear & Particle Physics*

C

7 – (PHYSI/12_SL_Summer_2017_Q26) – *Atomic,nuclear & Particle Physics*

C

8 – (PHYSI/12_SL_Summer_2017_Q27) – *Atomic,nuclear & Particle Physics*

B

9 – (PHYSI/10_SL_Winter_2017_Q23) – *Atomic,nuclear & Particle Physics*

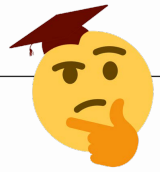
D

10 – (PHYSI/10_SL_Winter_2017_Q24) – *Atomic,nuclear & Particle Physics*

B

11 – (PHYSI/10_SL_Winter_2017_Q25) – *Atomic,nuclear & Particle Physics*

C



12 – (PHYSI/11_SL_Summer_2018_Q24) – *Atomic,nuclear & Particle Physics*

A

13 – (PHYSI/11_SL_Summer_2018_Q25) – *Atomic,nuclear & Particle Physics*

C

14 – (PHYSI/11_SL_Summer_2018_Q26) – *Atomic,nuclear & Particle Physics*

D

15 – (PHYSI/11_SL_Summer_2018_Q27) – *Atomic,nuclear & Particle Physics*

C

16 – (PHYSI/12_SL_Summer_2018_Q24) – *Atomic,nuclear & Particle Physics*

D

17 – (PHYSI/12_SL_Summer_2018_Q25) – *Atomic,nuclear & Particle Physics*

A

18 – (PHYSI/12_SL_Summer_2018_Q26) – *Atomic,nuclear & Particle Physics*

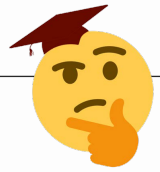
C

19 – (PHYSI/12_SL_Summer_2018_Q27) – *Atomic,nuclear & Particle Physics*

C

20 – (PHYSI/10_SL_Winter_2018_Q24) – *Atomic,nuclear & Particle Physics*

B



21 – (PHYSI/10_SL_Winter_2018_Q25) – *Atomic,nuclear & Particle Physics*

A

22 – (PHYSI/10_SL_Winter_2018_Q26) – *Atomic,nuclear & Particle Physics*

D

23 – (PHYSI/10_SL_Winter_2018_Q27) – *Atomic,nuclear & Particle Physics*

B

24 – (PHYSI/10_SL_Winter_2018_Q28) – *Atomic,nuclear & Particle Physics*

D

25 – (PHYSI/11_SL_Summer_2019_Q26) – *Atomic,nuclear & Particle Physics*

A

26 – (PHYSI/11_SL_Summer_2019_Q27) – *Atomic,nuclear & Particle Physics*

B

27 – (PHYSI/11_SL_Summer_2019_Q28) – *Atomic,nuclear & Particle Physics*

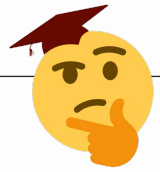
C

28 – (PHYSI/12_SL_Summer_2019_Q24) – *Atomic,nuclear & Particle Physics*

A

29 – (PHYSI/12_SL_Summer_2019_Q25) – *Atomic,nuclear & Particle Physics*

D



30 – (PHYSI/12_SL_Summer_2019_Q26) – *Atomic,nuclear & Particle Physics*

C

31 – (PHYSI/12_SL_Summer_2019_Q27) – *Atomic,nuclear & Particle Physics*

C

32 – (PHYSI/12_SL_Summer_2019_Q28) – *Atomic,nuclear & Particle Physics*

B

33 – (PHYSI/10_SL_Winter_2019_Q24) – *Atomic,nuclear & Particle Physics*

B

34 – (PHYSI/10_SL_Winter_2019_Q25) – *Atomic,nuclear & Particle Physics*

A

35 – (PHYSI/10_SL_Winter_2019_Q26) – *Atomic,nuclear & Particle Physics*

C

36 – (PHYSI/10_SL_Winter_2019_Q27) – *Atomic,nuclear & Particle Physics*

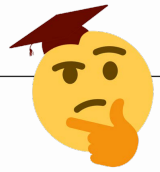
B

37 – (PHYSI/10_SL_Winter_2020_Q24) – *Atomic,nuclear & Particle Physics*

C

38 – (PHYSI/10_SL_Winter_2020_Q25) – *Atomic,nuclear & Particle Physics*

B



39 – (PHYSI/10_SL_Winter_2020_Q27) – *Atomic,nuclear & Particle Physics*

D

40 – (PHYSI/10_SL_Winter_2020_Q28) – *Atomic,nuclear & Particle Physics*

A

41 – (PHYSI/10_SL_Winter_2020_Q29) – *Atomic,nuclear & Particle Physics*

A

42 – (PHYSI/10_SL_Winter_2020_Q30) – *Atomic,nuclear & Particle Physics*

A

43 – (PHYSI/11_SL_Summer_2021_Q24) – *Atomic,nuclear & Particle Physics*

C

44 – (PHYSI/11_SL_Summer_2021_Q25) – *Atomic,nuclear & Particle Physics*

B

45 – (PHYSI/11_SL_Summer_2021_Q26) – *Atomic,nuclear & Particle Physics*

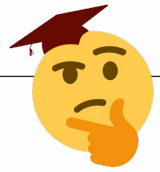
A

46 – (PHYSI/11_SL_Summer_2021_Q27) – *Atomic,nuclear & Particle Physics*

B

47 – (PHYSI/12_SL_Summer_2021_Q25) – *Atomic,nuclear & Particle Physics*

B



48 – (PHYSI/12_SL_Summer_2021_Q26) – *Atomic,nuclear & Particle Physics*

B

49 – (PHYSI/12_SL_Summer_2021_Q27) – *Atomic,nuclear & Particle Physics*

D

50 – (PHYSI/12_SL_Summer_2021_Q28) – *Atomic,nuclear & Particle Physics*

D

51 – (PHYSI/10_SL_Winter_2021_Q24) – *Atomic,nuclear & Particle Physics*

C

52 – (PHYSI/10_SL_Winter_2021_Q25) – *Atomic,nuclear & Particle Physics*

B

53 – (PHYSI/10_SL_Winter_2021_Q26) – *Atomic,nuclear & Particle Physics*

D

54 – (PHYSI/10_SL_Winter_2021_Q27) – *Atomic,nuclear & Particle Physics*

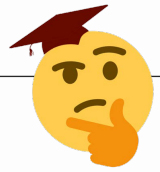
C

55 – (PHYSI/11_SL_Summer_2022_Q24) – *Atomic,nuclear & Particle Physics*

C

56 – (PHYSI/11_SL_Summer_2022_Q25) – *Atomic,nuclear & Particle Physics*

D



57 – (PHYSI/11_SL_Summer_2022_Q26) – *Atomic,nuclear & Particle Physics*

C

58 – (PHYSI/11_SL_Summer_2022_Q27) – *Atomic,nuclear & Particle Physics*

C

59 – (PHYSI/12_SL_Summer_2022_Q25) – *Atomic,nuclear & Particle Physics*

B

60 – (PHYSI/12_SL_Summer_2022_Q26) – *Atomic,nuclear & Particle Physics*

D

61 – (PHYSI/12_SL_Summer_2022_Q27) – *Atomic,nuclear & Particle Physics*

C

62 – (PHYSI/10_SL_Winter_2022_Q23) – *Atomic,nuclear & Particle Physics*

A

63 – (PHYSI/10_SL_Winter_2022_Q24) – *Atomic,nuclear & Particle Physics*

D

64 – (PHYSI/10_SL_Winter_2022_Q25) – *Atomic,nuclear & Particle Physics*

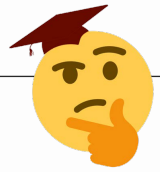
C

65 – (PHYSI/10_SL_Winter_2022_Q26) **–** *Atomic,nuclear & Particle Physics*

D

1 – (PHYSI/11_SL_Summer_2017_Q28) – *Energy Production*

B



2 – (PHYSI/11_SL_Summer_2017_Q29) – *Energy Production*

D

3 – (PHYSI/11_SL_Summer_2017_Q30) – *Energy Production*

D

4 – (PHYSI/12_SL_Summer_2017_Q28) – *Energy Production*

A

5 – (PHYSI/12_SL_Summer_2017_Q29) – *Energy Production*

D

6 – (PHYSI/12_SL_Summer_2017_Q30) – *Energy Production*

D

7 – (PHYSI/10_SL_Winter_2017_Q26) – *Energy Production*

C

8 – (PHYSI/10_SL_Winter_2017_Q27) – *Energy Production*

C

9 – (PHYSI/10_SL_Winter_2017_Q28) – *Energy Production*

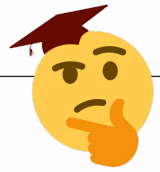
B

10 – (PHYSI/10_SL_Winter_2017_Q29) – *Energy Production*

A

11 – (PHYSI/11_SL_Summer_2018_Q28) – *Energy Production*

B



12 – (PHYSI/11_SL_Summer_2018_Q29) – *Energy Production*

B

13 – (PHYSI/11_SL_Summer_2018_Q30) – *Energy Production*

A

14 – (PHYSI/12_SL_Summer_2018_Q28) – *Energy Production*

D

15 – (PHYSI/12_SL_Summer_2018_Q29) – *Energy Production*

A

16 – (PHYSI/12_SL_Summer_2018_Q30) – *Energy Production*

B

17 – (PHYSI/10_SL_Winter_2018_Q29) – *Energy Production*

D

18 – (PHYSI/10_SL_Winter_2018_Q30) – *Energy Production*

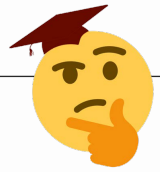
B

19 – (PHYSI/11_SL_Summer_2019_Q30) – *Energy Production*

B

20 – (PHYSI/12_SL_Summer_2019_Q29) – *Energy Production*

D



21 – (PHYSI/12_SL_Summer_2019_Q30) – *Energy Production*

D

22 – (PHYSI/10_SL_Winter_2019_Q28) – *Energy Production*

B

23 – (PHYSI/10_SL_Winter_2019_Q29) – *Energy Production*

A

24 – (PHYSI/10_SL_Winter_2019_Q30) – *Energy Production*

C

25 – (PHYSI/10_SL_Winter_2020_Q26) – *Energy Production*

C

26 – (PHYSI/11_SL_Summer_2021_Q28) – *Energy Production*

D

27 – (PHYSI/11_SL_Summer_2021_Q29) – *Energy Production*

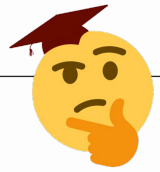
D

28 – (PHYSI/11_SL_Summer_2021_Q30) – *Energy Production*

A

29 – (PHYSI/12_SL_Summer_2021_Q29) – *Energy Production*

A



30 – (PHYSI/12_SL_Summer_2021_Q30) – *Energy Production*

B

31 – (PHYSI/10_SL_Winter_2021_Q28) – *Energy Production*

A

32 – (PHYSI/10_SL_Winter_2021_Q29) – *Energy Production*

B

33 – (PHYSI/10_SL_Winter_2021_Q30) – *Energy Production*

A

34 – (PHYSI/11_SL_Summer_2022_Q28) – *Energy Production*

D

35 – (PHYSI/11_SL_Summer_2022_Q29) – *Energy Production*

D

36 – (PHYSI/11_SL_Summer_2022_Q30) – *Energy Production*

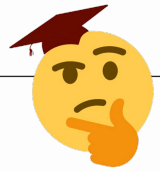
A

37 – (PHYSI/12_SL_Summer_2022_Q28) – *Energy Production*

C

38 – (PHYSI/12_SL_Summer_2022_Q29) – *Energy Production*

A



39 – (PHYSI/12_SL_Summer_2022_Q30) – *Energy Production*

A

40 – (PHYSI/10_SL_Winter_2022_Q27) – *Energy Production*

A

41 – (PHYSI/10_SL_Winter_2022_Q28) – *Energy Production*

B

42 – (PHYSI/10_SL_Winter_2022_Q29) – *Energy Production*

A

43 – (PHYSI/10_SL_Winter_2022_Q30) – *Energy Production*

A

1 – (PHYSI/10_SL_Winter_2018_Q17) **–** *Oscillations & Waves, Wave Phenomena (ahl)*

D